

# SCIENTIFIC AMERICAN



Vol. CX. No. 8  
February 21, 1914

Munn & Co., Inc., Publishers  
New York, N. Y.

Price 10 Cents  
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## The "Efficiency" of the Fire-fly



"MAZDA—not the name of a thing,  
but the mark of a service"

PRIMITIVE man once used lanterns holding swarms of fire-flies to guide him when he went forth at night.

Today, as Waldemar Kaempffert points out in an article on "The Light of Our Descendants" printed by the *Outlook*, the illuminating specialists of two continents are studying the firefly for a solution of one of mankind's greatest problems—artificial light.

To imitate the firefly—to get a great deal of light with but little heat waste—has been the steadfast aim of technical experts in electric lighting since the study of electric light became a science.

Step by step science has advanced in its search for this economy in the fuel of life.

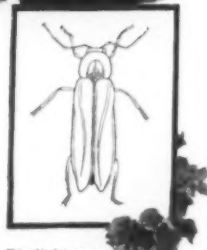
That is what the much used word "efficiency" means to electric lighting science—more light without increasing cost.

The farthest advance in this study of lighting economy has been

what they are doing while you are reading this article. It tells you also of what they will be doing tomorrow, and next month, and

next year, because it is the trade mark designation of the incessant effort "MAZDA" Service is making toward the ideal light.

On the lamps themselves the mark "MAZDA" means the selection of every "efficiency" discovery these Research Laboratories may find applicable and practical. Not content with wide investigation and experiment in these Research Laboratories, and in the active developing and manufacturing centers at Harrison and Cleveland, there is close touch also with progress that



The light produced by the firefly has challenged the lamp experts of two continents

may be made by great experimental laboratories of Europe.

From whatever source the new knowledge comes it is impartially considered with reference to its possible value in enabling the manufacturers to produce for you a lamp more "efficient" or adaptable. The proved advances, year after year, are transmitted by this "MAZDA" Service to the General Electric Company factories and the factories of other Companies entitled to receive this Service.

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reached in the work of the famous group of scientists in the Research Laboratories of the General Electric Company at Schenectady. These experts selected and approved the features of a lamp that gives a beautiful light—three times as much light, with the same amount of current, as you get from the old style carbon lamp.

On the bulb of this lamp is etched the mark "MAZDA."

"MAZDA" is the mark of a Service. It tells you of the great work that these busy men have done for the manufacturers of "MAZDA" lamps. It tells you

The result is that when you buy a "MAZDA" lamp, to-day or at any future time, "MAZDA" Service will shine in that lamp. You will know when you see that word "MAZDA" that you have the utmost result of all this indefatigable labor—the summed up success of these keenest lamp experts in the world. For the lamp so marked will always mean that this Service has been applied and the manufactured product backed by this Service will always be marked "MAZDA."



GENERAL ELECTRIC COMPANY

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For  
Manufacturing  
**ALCOHOL**  
and other  
Products of the  
Process

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No. 1610—A General Review of the Subject of utilizing wood wastes, and the uses to which the wastes may be put.

No. 1684—The "steam" and "destructive" distillation processes, and names the numerous products obtainable from the complete operation.

No. 1661—Distillation of soft wood, and gives the proportions and quantities of each product obtainable, and the various processes used.

Nos. 1723 and 1724—The general subject of the utilization of wood wastes, giving all the products by a clear and valuable diagram showing their relations to each other, and many illustrations of apparatus.

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No. 1335—Charcoal manufacture in Germany, with complete recovery of by-products, their description and uses.

No. 1472—"Distillation of Pine Products" refers especially to turpentine manufacture, but covers the by-products as well, and gives information of the profitable nature of the business.

No. 1151—Refers to acetic acid, wood spirit and acetone from distillation of wood, and gives a good description of the necessary apparatus, and particularly of the points to be observed in operating the plant.

No. 1736—Production of Alcohol from Cellulose, how wood and wood products may be used.

No. 1656—Turpentine from waste wood.

No. 1910—The production of ethyl alcohol from waste products (sawdust, etc.)

No. 1915—Experiments on the hydrolysis of sawdust, sugar and alcohol from wood.

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Scientific American Supplement Nos. 1754, 1755 and 1756—The Oxy-hydrogen Process of cutting and welding metals is a series covering the important applications of this remarkable process.

Scientific American Supplement No. 1903—Theory of the Welding of Steel and its Practical Application. This paper gives much valuable data on how welding operations should be conducted in solid and autogenous processes.

Scientific American Supplement No. 1646—Oxy-Hydric Welding, gives a description of processes and cost.

Scientific American Supplement No. 1775—New Gas Fusion Process, describes the Koeln Muesener improvement in oxy-hydric apparatus.

Scientific American Supplement No. 1680—The Oxy-Acetylene Process, sets forth the uses and cost of this system.

Scientific American Supplement No. 1434—The Garutt Process of Generating Oxygen and Hydrogen, describes an economical way of making and using these gases for welding.

Scientific American Supplement Nos. 1305, 1447, 1480 and 1873 on "Aluminothermy" or "Thermit" processes, describe and illustrate many remarkable welds, castings and other operations performed with the novel and useful series of metallic compounds, by which castings of steel and other metals and difficult welds can be easily made without forge, cupola or any sort of fireplace.



SEVENTIETH YEAR

# SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CX]  
NUMBER 8.]

NEW YORK, FEBRUARY 21, 1914

[ PRICE 10 CENTS  
\$3.00 A YEAR

Blind visitors listening to a lecture before examining a human skeleton. The demonstration is preceded by a short lecture by a capable local specialist.



Blind men studying the form and mechanism of firearms.



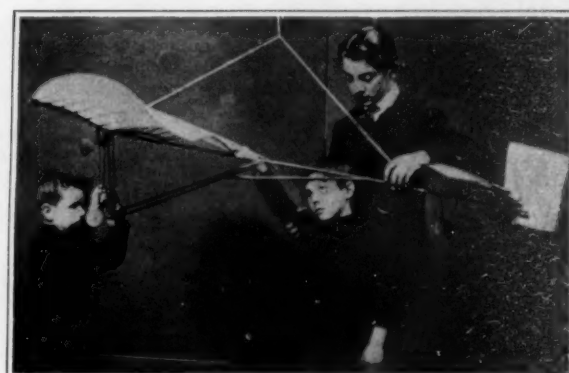
"Now we know how big a lion is, but we couldn't ride a live one, could we?" Blind children making an interesting study in natural history.



Gaining impressions of a bridge and a locomotive engine, through step by step patient examination of the structural difficulties of the parts and sections.



The human skeleton. An investigation into what it is like.



"What should I see if I saw an aeroplane?" An object lesson for boys by a demonstrator who guides the hand over the features of the specimen.

## Showing Museums to the Blind

By Percy Collins

MUCH has been done in all civilized countries to alleviate the hard lot of the blind, but it has been left to Mr. J. A. Charlton Deas, of Sunderland (England) to point out that the educational advantages of our museums and art galleries may be made available to the sightless members of the community. At first thought this assertion seems hard to credit. But Mr. Deas, who is librarian and museum director to the Corporation of Sunderland, has put his theories to the test, and has proved their soundness beyond all possibility of quibble. Briefly, the methods he adopts are as follows: Each demonstration is preceded by a short lecture, delivered in simple language by capable local specialists—the information given being just that interesting outline which is required by a person approaching a subject for the first time. At the close of the lecture, each blind person is taken in hand by a competent guide—one of a body of ladies and gentlemen whose co-operation had previously been secured. The business of the guides is to assist their charges to examine the series of specimens set forth for their edification. Attached to each specimen is a carefully prepared descriptive label. This is read aloud by the guide, and supplemented by any interesting knowledge of the object which he or she may possess. The hands or fingers of the blind person are then guided to the important features of the specimen. "This conscientious guiding of the blind person's hands," writes Mr. Deas, "is by no means a simple matter. When it is remembered that the voice must be used to explain each feature at the moment of touch, and that in this way only one person can be satisfactorily dealt with at a time, it will be realized that an afternoon of such work is not without its fatigue, but a fatigue that is more than recompensed by the most convincing expressions of gratitude on the part of the recipient."

In order that each blind visitor should have an op-

portunity to examine every object, a small card giving a list of the specimens is attached to the coat-lapel or dress, and each item is ticked off when it has been thoroughly handled. The foregoing remarks apply specially to the adult blind, who were invited to attend demonstrations on Sunday afternoons. On the Mondays following, however, the same programme was gone through for the benefit of blind children from the Council School. At these juvenile demonstrations an expert blind teacher was present, who, having already heard the lecture on the previous day, was well able to bring out the points that he knew from experience would be specially interesting to his young charges, and to explain them in a comprehensible manner. It is a noteworthy fact that many blind children are remarkably quick to assimilate instruction, and use their hands with great dexterity; a point which seems to support the views of Dr. Montessori, the new educationist, who claims that the natural way for little ones to learn about things is to touch them.

Mr. G. I. Walker (the expert blind teacher of the blind referred to above), in a letter to Mr. Deas, writes: "The satisfactory point in connection with the demonstrations is that the interest has deepened as time has passed. Discussions in the Blind Institute and elsewhere have become varied and interesting, and show that the minds of those attending have been awakened and stimulated, and made to understand that they are indeed deficient, and sadly ignorant of what is around them. This has not produced any appreciable sense of bitterness and discomfort, but has made them more sensible of the kindness and thoughtfulness that have so generously sought to bring them into contact with so many things in such pleasant fashion."

## The Center of the Stars

IN a communication to the Royal Astronomical Society Mr. Turner has shown that there is a center to the stellar universe such that as we recede from it the stars become fewer in number and their velocities de-

crease. He shows that the division of the celestial bodies into two classes, of which the members of one class approach the center while the members of the other class recede from it, give to the terrestrial observer the appearance of their being two main directions. On this theory is explainable the relation between the velocities of the stars and the nature of their spectra, the birth of movements of rotation in opposite directions in the same nebula and the occurrences of a preponderating number of new stars in the constellation Gemini. The direction thus found for the center of the stellar universe differs but little from that deduced by Mr. Lewis from statistical observations on double stars.

## Staircase Drawers

A SOMEWHAT curious idea is to put drawers in the staircase and so make use of otherwise wasted space. This may prove to be quite useful in some cases, especially in small modern houses, where even the least space needs to be made use of, owing to the lack of cupboards, which are generally absent. Drawers of this kind can be made to hold all kinds of household cleaning material, brushes, dusters and the like, as well as many objects that are not often needed. One point is that the drawers should be kept tight shut, for there is always plenty of dust on the staircase, and again, should one of them be left open, it might trip up a person who is going downstairs.

**Congress on Hygiene and Demography.**—The Government Printing Office, in Washington, has just completed the publication of the Transactions of the Fifteenth International Congress on Hygiene and Demography, Washington, September 23-28th, 1912. It is a voluminous document, comprising 6 volumes, some of which are in 2 parts each, so that there are 9 large books in all. This work is being distributed by the secretary general of the Congress, Dr. John S. Fulton, Maltby Building, Washington, D. C.

# SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, FEBRUARY 21, 1914

Published by Munn & Co., Incorporated. Charles Allen Munn, President, Frederick Converse Beach, Secretary and Treasurer  
all at 361 Broadway, New York

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Subscription Rates	
Subscription one year.....	\$5.00
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Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles short, and the facts authentic, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

## President Wilson on Canal Tolls

EVERY high-minded American citizen, who puts the honor and fair name of his country above every other consideration, must have felt a heavy burden lifted from his national conscience when he learned that President Wilson favors the repeal at this session of Congress of the provision of the Panama Canal Act exempting American coastwise vessels from the payment of tolls. Mr. Wilson, who had already shown himself to be one of the most just, fearless and powerful Presidents that have filled the Executive Office, has expressed his determination that the iniquitous canal toll act shall be rescinded; and in bringing his powerful hand to bear upon Congress in this matter, we believe that he will have American public opinion behind him.

Anyone with common sense and an elementary sense of honor does not have to look very far into this question to see that it involves a distinct and deliberate breach of national good faith. In the year 1901 there was a treaty concluded between the United States and Great Britain, known as the "Hay-Pauncefote Treaty," in which, in view of Great Britain's agreeing to give up certain rights which she possessed at the Isthmus of Panama, the United States agreed to operate the canal under similar working conditions as regards the ships of all nations making use of the canal. This will be readily understood if we quote article 3 of the above treaty, which reads as follows: "The United States adopts as the basis of the neutralization of such ship canal the following rule, substantially as embodied in the convention of Constantinople, signed the 28th of October, 1888, for the free navigation of the Suez Canal, that is to say: 1. The canal shall be free and open to the vessels of commerce and of war of all nations observing these rules on terms of entire equality, so that there shall be no discrimination against any such nation or its citizens or subjects, in respect of the conditions or charges of traffic or otherwise."

Now one does not have to be a lawyer to see that the passage of a law last year which exempted the ships of our coastwise traffic from paying tolls and imposed tolls on the ships of other nations was a distinct breach of faith on the part of our Government. The question is one of plain day-by-day morality; matters of moral right are universal in their application; and the code of honor is just as strict in its obligations on a powerful government like our own, as it is upon the individual citizen. Nay, is it not infinitely more binding? A breach of faith on the part of one man concerns himself only; but a breach of faith on the part of our Government reflects upon every one of the one hundred millions of people who live beneath its flag.

In some of the written and spoken discussions of this canal act as expressed on the platform and even in Congress itself, there has been exhibited a naive moral obliquity which would be regrettable in a child, bewildering in an adult, and is shocking and humiliating when it is found in the august halls of Congress.

Specious catchwords and misleading phraseology may easily divert the minds of a busy people from the real points at issue in a controversy of this kind. "We built the canal; why should we not make the other people pay for it?" "The United States has invested nearly \$400,000,000 in this enterprise; and why should we be called upon to play the part of the philanthropic benefactor by charging our own ships the same rate of toll as we charge the ships of other nations who have contributed not a single dollar to the great work?" The answer to this is that after a

careful review of the situation, and in view of the advantages to be secured by the abrogation of previously existing treaties affecting the Isthmus, and in view of the pledge of Great Britain that the Canadian and Suez canals shall be operated on terms of equality, the United States did enter into a solemn agreement to operate the Panama Canal upon terms of equality, and the passage of the recent act exempting our ships has placed us in a most deplorable situation in the eyes of the world, as having committed an act of international dishonor.

Furthermore, the President speaks of the exemption of our coastwise shipping from canal tolls as economically unjust. It certainly is. Such exemption would be simply to divert a portion of the reasonable profits of the canal into the pockets of certain private corporations. We cannot shut our eyes to this fact. The remission of these tolls will not mean the return of any profits of operation back to the National Treasury; and no amount of argument can prove that it will.

These, however, are entirely secondary considerations in view of the fact that the obnoxious act of last year has awakened throughout the world a distrust of our national good faith. "Let justice prevail though the heavens should fall," says the ancient adage, and a sentiment that was strong then is doubly binding today in an age that boasts of its advanced civilization.

There will be a fight to uphold this act exempting coastwise shipping—a bitter fight, no doubt; but with the President himself so strongly on the side of fair dealing, backed as he undoubtedly is, by the sentiment of the large majority of the nation, we look confidently for the repeal of an act which should never have been allowed to cast its shadow upon the history of our Federal legislation.

## Pittsburgh's Smoke Bill

SMOKING is a costly habit, whether the smoker happens to be a man or a town. Persons who have hitherto regarded the "smoke nuisance" as mainly an aesthetic problem will be startled by the revelations of Mr. J. J. O'Connor, Jr., who has been investigating the smoke of Pittsburgh from the practical viewpoint of dollars and cents.

Here are the items of Pittsburgh's yearly smoke bill:

Cost to the smoke maker in the imperfect combustion of fuel (of which smoke is the outward and visible sign), \$1,520,740. Better methods of stoking would not only do away with most of the smoke, but would effect a saving of 21.7 per cent in the present fuel consumption; in other words, about one fifth of the utilizable fuel of Pittsburgh factories now "goes up in smoke" and is a dead loss.

Cost to the individual citizen: (1) laundry bills, \$1,500,000; (2) dry cleaning bills, \$750,000. These figures do not represent the total laundry and cleaning business of the city, but merely the excess over what these items would be under ideal conditions of smoke regulation. The same principle applies to the figures quoted below in connection with other economic effects of the smoke nuisance. Pittsburgh is the greatest laundry town in the country, notwithstanding the fact that, with its large population of unskilled laborers, it has a greater percentage of citizens who do not patronize the laundries than almost any other city. The annual per capita laundry business is \$3.12; about one third greater than that of the average American city. Dry cleaning bills are far larger in Pittsburgh than in most other cities, despite the fact that Pittsburghers generally eschew light-colored clothing to such an extent that their city has come to be known as "the mourning town."

Cost to the household: (1) exterior painting, \$330,000; (2) sheet metal work, \$1,008,000; (3) cleaning and renewing wall paper, \$550,000; (4) cleaning and renewing lace curtains, \$360,000; (5) artificial lighting, \$84,000. Houses in Pittsburgh are painted every three years, while in most other cities the houses are painted every six or eight years. The sheet metal of roofs, gutters, spouts, etc., deteriorates twice as fast in the smoky atmosphere of Pittsburgh as in cities of average freedom from smoke, and therefore needs to be renewed twice as often. It also needs repainting about twice as often. About 10,000 Pittsburgh households have their wall paper cleaned once or twice a year by a professional cleaner—a functionary who is unknown in most other cities. Pittsburgh walls are repainted every two years; in other cities from six to ten years is the average. Lace curtains are washed in Pittsburgh three or four times a year, and silk curtains every two to four weeks. The greatest cost in this connection is due to the rapid wearing out entailed in frequent washing. The necessity for excessive artificial lighting in a smoky atmosphere is obvious.

Cost to wholesale and retail stores: (1) merchandise, \$1,650,000; (2) extra precautions, \$450,000; (3) cleaning, \$750,000; (4) artificial lighting, \$650,000; (5) department stores, \$175,000. Annual damage to merchandise due to smoke in typical stores, exclusive of department stores, ranges from \$75 in a drug concern

up to \$1,500 at a haberdasher's, \$2,000 at a florist's, and \$3,000 at a stationer's. The extra precautions to prevent damage to goods by smoke include additional labor, extra wrapping of cloth, books, or other articles when stored, screens to keep out dirt, coverings for goods, weather strips on windows, etc. The extra cost of cleaning requires no explanation. As to item (4), it is stated that 30 per cent of the artificial lighting in Pittsburgh is required by atmospheric conditions for which smoke is responsible. Under this item account is taken not only of the effects of diminished daylight, but also of the reduced efficiency of electric and other lamps resulting from the accumulation of soot on globes and shades. The losses experienced by department stores have been reckoned separately on account of the diversity of their stocks. These stores report damage to merchandise running up to \$25,000, and other items in proportion.

Cost to semi-public buildings: (1) office buildings, \$90,000; (2) hotels, \$22,000; (3) hospitals, \$55,000. The additional expense in these cases is analogous in its causes to that borne by private houses. It is found that Pittsburgh office buildings use 15 pounds of cleaning powder per thousand square feet per month, as against 11 required in New York, Boston, Philadelphia, Baltimore, or Washington.

The total bill foots up \$9,944,740 per annum; and no attempt has been made to include such items as depreciation in the value of property, absence of various industries which are practically excluded by a smoky atmosphere, and, last but not least, injury to human health.

## Rewards to Postal Employees for Inventions

THE appropriation act for the Post Office Department for the year ending June 30th, 1914, authorizes the Postmaster General to offer and pay periodically a cash reward for the invention, suggestion or series of suggestions for an improvement or economy applicable to the postal service submitted by one or more employees of the Post Office Department which shall be deemed the most valuable of those submitted and adopted for use, and for that purpose the sum of \$10,000 has been appropriated.

To obtain the reward the winning suggestion or invention must be one that will clearly effect a material economy or increase efficiency. The sum to be awarded as above to employees is in addition to their usual compensation. The total amount to be paid in any one month or for any one invention or suggestion is not to exceed \$1,000.

It is provided that no employee shall be paid a reward under the act until he has quit-claimed any further claim by him or his heirs or assigns and executed an agreement that no application for patent has been made for any such invention. It does not appear that the act requires that the employee or employees submitting the invention or suggestion shall be an inventor or originator. The prohibition of patent application is unfortunate, since such application leads to the only means provided by law for the judicial determination of priority of invention in case of a contest. In any event, it seems unwise for the Government by one legislative act to deprive an inventor of the benefits of another act, especially since the invention submitted for postal purposes might have a greater usefulness outside of such service and its benefit to the limited service would not be lessened by its more extensive employment elsewhere. A committee has been appointed by Postmaster General Burleson to consider and pass upon the merits of such improvements as may be submitted under the provision of the act.

## The Problem of Three Bodies.

THE mathematical problem known as the three bodies has resisted the attempts to solve it made by mathematicians from Lagrange to Poincaré. It has now at last been solved. This immensely difficult problem seems very simple. The problem is to express the motions of three bodies of any masses under the action of their mutual attractions, the attractions obeying, of course, Newton's law of gravitation. Poincaré, the great French mathematician, who has just died, did an immense amount of work on this problem, and although not completely solving it, obtained some very valuable results. He showed that in certain circumstances the bodies would be in the same positions again and again; in other words, that there existed periodic solutions. He also showed that a very remarkable case could exist where the bodies would first describe orbits which were nearly periodic, then gradually depart from the periodic form, and then again, after an immense lapse of time, approach the periodic form. But all these solutions broke down when the bodies actually came into collision. It has been reserved for Mr. Sundmann, astronomer at Helsingfors, to evolve a solution which remains true after the bodies have been in collision and thus to obtain a complete solution of this famous and seemingly unsolvable problem.



## Engineering

**Record Loading of a Steamer.**—What is surely a record for speedy loading is that held by the Great Lakes steamship "William E. Corey," which when at Two Harbors, Minnesota, took 10,100 tons of iron ore into her hold in 28 minutes. The "Corey" is of the hopper bottom type of construction.

**New York Harbor to Get \$500,000.**—A good start in the improvement of New York harbor has been made through the grant of \$500,000 by Congress as an initial appropriation for the East River improvement project, recently urged by the Mayor of this city. The project calls for blasting away Coenties Reef and Diamond Shoal off the Battery, and the removal of other rocks in the river which have proved dangerous to navigation.

**Increasing Size of Steam Turbines.**—There is an extraordinary development taking place in the size of the individual unit in the field of steam turbines. We were commenting a short while ago on the fact that a unit of 20,000 kilowatts had been built; yet during the past year one of this size and another turbine of 25,000 kilowatts have been built, and it is stated that orders have been placed for four of 30,000 kilowatts and one for 35,000 kilowatts.

**Three Boatmen to Each Lifeboat.**—It is gratifying to note that the Seamen's Bill provision of "two deckhands to each boat" has been checkmated by the provision of the International Conference that there shall be "not less than three efficient boatmen" for every lifeboat carrying sixty persons and more for larger boats. This will result, as it should, in firemen, stewards, coal passers and other members of the crew qualifying in the handling of boats.

**Larger Cylinders for Locomotives.**—The Test Department of the Pennsylvania Railroad has been carrying on experiments with superheater locomotives, as a result of which they have determined that when a locomotive is converted from saturated to superheated steam, her cylinders should be enlarged. The results obtained show that, to secure maximum economy, the cylinders should be enlarged to such an extent that the maximum indicated horse-power will be developed at a cut-off not exceeding 30 per cent.

**Thousand Foot Drydock for Navy.**—In his testimony before the House Naval Affairs Committee, Secretary Daniels advocated the construction at the navy yard, Norfolk, of a drydock of the internal dimensions of the Panama Canal, namely, 1,000 feet long, 110 feet wide, with a depth of 40 feet over the sill. Such a dock would accommodate the largest dreadnought that will ever be built for the United States Navy. That the dimensions are not too great is shown by the fact that some nations, at the present time, are building warships which are considerably over 700 feet in length.

**Government Railway for Alaska.**—The United States Senate is considering the Alaska Railroad Bill, which involves the expenditure of \$35,611,000 for the construction of 733 miles of railroad from a point on the southern coast of Alaska to the Yukon River. It is intended to make only \$1,000,000 immediately available. Possibly the Government will take over the 72-mile road which runs from Seward to the north, or the Copper River and Northwestern Railroad, 169 miles long, which runs from Cordova, making the one selected the first division of a general railroad system.

**Tenders Derail Trains.**—Mr. H. W. Belknap, of the Interstate Commerce Commission, commenting on a wreck last October in which 17 passengers were killed, and 139 passengers and 6 employees injured, finds that the derailment which caused this disaster took place at the forward truck of the tender. He states that on account of the comparatively short wheel base, high center of gravity, and movement of water in the cistern, consisting of surging back and forth and from side to side, the tender is subjected to overturning and derailing forces, which are aggravated by any irregularity which exists in the tracks. Derailments of this kind occur more or less frequently on every large railroad in the country, and they should be given the closest possible study to ascertain their causes and, as far as is practicable, eliminate them.

**New Type of Arched Dam Construction.**—A new dam has been built in the Big Bear Valley, which proves that, where suitable foundations can be found, it is not necessary to build the huge and costly solid gravity dam, which has hitherto been the prevailing type. The new dam consists of a series of thin arched walls, with the convex faces upstream, which abut against a series of parallel longitudinal walls extending down stream. The latter serve to transfer the thrust of the water to the ground. The new dam has a factor of safety of 13.5, allowing the crushing strength of the concrete to be 3,000 pounds to the square inch. Timidity alone has hitherto prevented engineers from building this type of dam, which is here shown to be perfectly stable, very much cheaper than the gravity dam, and cheaper even than the single-arch dam which the present structure replaces at this site.

## Electricity

**A Wireless Determination of Longitude** has been made in French West Africa between Konakry and Kissidugu. Astronomical observations were first made at the two stations; then the Kissidugu chronometer was compared with the Konakry electromagnetic clock by means of wireless signals; and the results were checked by a further set of astronomical observations.

**Wireless at the Lindenberg Observatory.**—The aerological observatory at Lindenberg, which is the headquarters of Germany's storm-warning service for aeronauts, has been equipped with wireless telegraphy. The new installation will communicate with the wireless outfits on aircraft, and will serve the double purpose of disseminating meteorological information and of warning aeronauts to look out for kite-wires in the neighborhood of the observatory. At night a fixed searchlight and a flashlight are to be used to indicate the position of the observatory, and further aid in preventing collisions with kite-wires.

**Electric Automobile Charging Station.**—The New York Electric Vehicle Association has issued a booklet containing a list of charging stations within a hundred-mile radius of New York city. Also a map showing the exact location of the charging stations. In the majority of cases under the charging station the following data are given: Maximum amperage available; maximum voltage available; hours during which service is available; prices charged for boosting. The booklet should prove invaluable to owners of electric automobiles in the vicinity of New York, and should do much toward the promotion of the electric vehicle for out of town use.

**Efficiency of the Battery-driven Tractor.**—About a year ago the Pennsylvania Railroad put into service in Jersey City, N. J., a battery-driven tractor to haul freight cars through the streets. Previous to that the work was done with horses. A report has recently been published on the cost of maintenance and operation of the tractor for seven months. The total cost, including interest and depreciation, is \$4,627.88. Had horses been used instead, the cost for the same work would have been \$9,179.10, so that the tractor shows a saving for seven months of \$4,551.22. Seven thousand seven hundred and twenty-three cars were handled and the cost of the service per car was 0.938 cent, while the cost of the service per ton was 0.028 and per ton mile 0.067 cent.

**Heat-storing Magazine.**—An inventor in Stockholm, Sweden, has devised an apparatus for storing heat. It consists of a mass of heat-absorbing material, in which is placed a coil of resistance wire. Surrounding the heat-storing material is heat-insulating material, while at the top is a damper which may be operated to permit the heat stored in the magazine to radiate out of the top. The entire apparatus is inclosed in a heat-radiating cover. To facilitate the radiation of heat there is a system of air passages through the heat-storing materials. The apparatus is adapted to be used during off-peak periods, storing heat which may be used as needed. An experimental apparatus about a yard high, 25 inches long and 15 inches wide showed a storing capacity of about 25,000 kilogramme calories, while a temperature in the storing magazine of about 600 deg. Cent. or about 1,100 deg. Fahr. was obtained.

**Electric Sterilization of Milk.**—The sterilization of milk by electricity without injury to flavor or nutritive qualities bids fair to become a regular practice. Recent attempts to kill the bacteria in milk by brief exposure to the ultra-violet light from a quartz mercury-vapor lamp have attracted considerable interest, but these attempts have not resulted in success. The milk is so opaque to the rays that it was necessary to expose it in thin sheets and then a dangerous fraction of the bacteria escaped the killing process. Another objection has been that the necessary intensity of ultra-violet light gave an unpleasant taste to milk. Another process has been developed at the University of Liverpool under a grant from the City Council and the experiments, carried on for the past two years, are most promising. Exact details of the method have not yet been made public, but it is stated that a high-tension electric current is used and that the exposure is exceedingly brief. The taste of the milk is not changed in the least, nor is the "bouquet" lost. Expert dairymen testified that they could not detect any difference in treated and untreated samples. In fact, the City Analyst found no change in the composition of milk so treated or at least so little as to be negligible. It seems remarkable that the acidity did not increase. Naturally there was no coagulation. Heating was trifling. All pathogenic or dangerous bacteria were killed by the electrification, and it was stated by the scientists that perfect sterilization could be secured with longer treatment. The feeding tests so far have been made on kittens which grew fat on the sterilized milk. Guinea-pigs inoculated with tuberculous milk that had been electrically treated failed to develop the disease. The city of Liverpool has made the investigation official.

## Automobile

**Wanted: Method of Keeping Seats Dry.**—In the city of London, where self-propelled 'buses form such an important part of the transportation system, difficulty has been experienced in keeping dry the outside seats. In consequence, the London General Omnibus Company, which operates by far the greatest number of 'buses, is inviting inventors to submit ideas to overcome the trouble. The ideas should be sent to the chief engineer of the company, whose address is 9 Grosvenor Road, Westminster.

**Effect of Corseting on Upholstery.**—It has been advanced by persons who are in a position to know that the styles in ladies' corsets exert a marked influence upon the design of automobile upholstery. This is explained by the fact that whereas one style of corset, in vogue to-day, may encourage a luxurious lolling position of the wearer, another style, in vogue to-morrow, may compel a severely upright position. Consequently designers find it incumbent to study other things besides automobile engineering.

**Nothing New Under the Sun.**—The illustration and description of an electric device to assist carburetion, which was published in our Automobile number, brings to mind that a device of a somewhat similar nature was used as long ago as 1903. It was applied to a surface carburetor on a motor bicycle and consisted briefly of a coil of iron wire wrapped inside the intake pipe. The wire was heated by passing through it a current of electricity from an accumulator. The device worked well but nearly caused an explosion owing to the fact that it created rather too much heat.

**A Shortcoming of Cooling Systems.**—Despite the plane of perfection to which the modern automobile water cooling system has been brought, the fact nevertheless remains that it has an inherent defect that should be plainly apparent to anyone who has eyes to see. The fan behind the radiator is designed to draw air in through the tubes of the cooler, and because its action cannot be made discriminatory, it continues to invite inside all manner of dust and dirt and winged insects. One foreign manufacturer has eliminated this trouble by causing the air drawn in at the front to be expelled at the sides of the radiator. With the widespread use of radiators, it seems that there is room for the exercise of ingenuity, which almost certainly would be rewarded, for the need of a better method of directing the circulating currents of cool air is real.

**Things that Militate Against Pneumatic Engine Starters.**—Size and weight of parts, together with a degree of complexity that is permissible only in view of the result accomplished, have militated somewhat against the general use of compressed air engine starting devices. Coupled with these disadvantages there always has been, and probably there always will be, the objectionable propensity of compressed air to escape its bonds on the slightest provocation. It is not the easiest matter in the world to confine compressed air in such a way that the pressure will remain practically constant for long periods, and when the problem is augmented by subjecting the apparatus to the continual vibration that is impossible of elimination in the automobile, the difficulties attendant upon the satisfactory use of air as an engine starting medium are considerably increased.

**Electric Lights at Low Cost.**—While it goes without saying that an electric lighting system is a most desirable feature in an automobile, the high prices at which most of such systems are offered to the public precludes their use by many owners. Realizing this, a well-known manufacturer of automobile specialties has just brought out a new electric lighting system, of novel construction, the principal feature of which is that it can be installed easily and sells for only \$12. The system comprises a dash lamp, a tail light and a portable trouble lamp. The body of each lamp is made of hard rubber instead of metal and contains a powerful lens. The tail lamp has a red lens for the warning signal and a slot underneath, with a white light for illuminating the license plate.

**A New Type of Motor Vehicle Tire.**—There has appeared upon the market a brand new type of automobile tire in which rubber or rubber compounds of any kind are conspicuous by their absence. Despite this fact, it is said that the shock absorbing proclivities of the tire are quite equal to those of the rubber variety. The tire is composed wholly of cotton fabric which is made waterproof and compressed into a steel rim, the threads running diagonally from tread to base. No adhesives, binders or compounds are used. A somewhat peculiar characteristic of the tire is that after use it picks up a coating of grit and small particles from the road which become partly imbedded in the fabric and sustain much of the wear. The tire has a shock absorbing quality somewhat akin to that of a bag of meal that is struck a heavy blow; rebound is missing. The tire weighs approximately 30 per cent less than a solid rubber tire of the same size. Although developed primarily for commercial vehicles, the tire can be used on pleasure cars.

## A Flat Band With Only One Surface and One Edge

By Carl Hering

SOME intellectual entertainment may be obtained by taking a strip of paper, say an inch wide and 8 or 10 inches long, and asking others to manipulate it in some way so that it will have only one surface and one edge. Originally it has two surfaces and four edges; by pasting the two ends together so as to produce an ordinary ring like a napkin ring, it will still have two surfaces, but now only two edges.

Although generally thought impossible at first, it is really quite simple. The solution consists in pasting the two ends together as though such a ring were to be formed, but first giving the strip a twist of half a turn. The former two surfaces and two edges will now form only one continuous surface and only one continuous edge.

Further entertainment may be obtained by cutting the ring in the direction of the length of the band, as though forming two narrower rings of it, and asking whether these two rings will be linked or unlinked. The guesses will generally be evenly divided, but both are wrong, as it forms only one ring of double the diameter. If the large ring thus formed is again cut in the same way, one might now expect it to double in size again, but it will surprise one again by this time forming two rings doubly interlinked. When the original is similarly cut into three parts it will form one small ring and one large one interlinked with it. By giving the original strip a whole twist instead of a half, it will have two surfaces and edges and will cut into two rings linked once. Three or five half twists again form a ring with but one surface and one edge, and will cut up into other though more complicated oddities, one of which is a single ring with a knot tied into itself, somewhat resembling a pretzel.

The single surface ring is also of interest as a mechanical and mathematical oddity. To show its true shape when it is formed according to a regular law, the writer had a model constructed. In its simplest form this law is, to consider the center line of the ring to be a circle, and the band is then described by a short line perpendicular to the circle and bisected by it, moving along the circle and at the same time turning or revolving around that part of the circle as an axis, so that when it has made its complete circuit of 360 degrees around the circle it has made a half turn around its axis, that is, 180 degrees, the two movements being, of course, perfectly regular, one degree of revolution for every two degrees of advance.

An ordinary strip or band of paper or metal made into such a ring as described above, will not take the shape of the regular form, as it would have to bend edge-wise to do so, because one edge would have to be greatly stretched and the other greatly compressed. A paper or sheet metal ring will take an oval shape, in which the helical twist is mostly in one half and the cylindrical bend mostly in the other half.

The correct shape can be obtained only in a model free from any internal strains. Hence it was made of a toro or thick round ring of wood, of circular cross section, as shown in Fig. 1. On the outside of this was then drawn the spirally shaped edge, and the part not wanted was cut away. The edge of the finished ring is therefore a part of the original surface of this toro. The band ring, thus formed, is shown in Fig. 2. Being made of wood, it had to be given considerable thickness for the sake of strength. Bands running lengthwise were painted on it in order to show its properties to better advantage. The white line at the center forms a circle (if the thickness is neglected), and if all the rest were cut away, this portion would form a circular ring whose solid part has a square cross section, and a twist of half a turn.

If a narrow strip of paper were laid on the surface of this white band, completely covering it, and had its beginning fastened to its end, it would when removed form a single ring of double the diameter of the original. If the same were done with the bands near the edge, two rings of double the diameter would result.

If the model were cut through between the white band and those near the edge, and supposing it were made of some flexible material, a large and a small ring interlinked with it, would be produced. When the width of the band is made greater, for the same center line diameter, the oddity of the shape becomes more

pronounced. When the width equals the center line diameter the edge passes through the center where it is, for a very short distance, coincident with the axis. When the width is increased still more a peculiar reversal of curvature takes place. A limit to the width is reached when the edge touches the other side of the ring, that is, when the width is nearly twice the diameter, depending on the thickness of the band.

When revolved on its axis it produces a flow of air, hence acts as a noiseless fan as distinguished from those with blades which produce a succession of puffs. It also acts as a mixer for concrete or ice cream.

The peculiar surface of this ring occurs in nature in the conch shell, though somewhat imperfectly. A round rubber ring like an umbrella ring, when split in the direction of the planes of this single surface ring, will form a ring of double the diameter.

When such a ring is cast of a soft metal like lead, then cut in the plane of the axis, unrolled and untwisted, so as to form a flat strip, it has the shapes shown in Figs. 3 and 4, differing in where it is cut. Hence if a piece of sheet metal is cut to one of these shapes and then has its ends brought together, after giving it a half twist (*a* to *a*, *b* to *b*, etc.) it will approach the regular form. The horse-shoe template (Fig.

special interest, as there is a regularity or symmetry in its irregularity, and the twists may be made any multiple of one third. It cuts up into a variety of rings depending upon the direction of the cut.

When any of these rings, particularly those of the latter kind, are revolved around their axis, they will give a very good reproduction of the characteristic revolution of a vortex ring, more commonly represented by the usual smoke ring. This is made more evident by painting bands of different colors on them, like those on the models here shown.

The rings will then appear to be revolving around their circular center line as an axis, precisely as the vortex ring does. In fact, they then actually constitute a kind of vortex ring and ought therefore to have some of the properties of such rings, like rolling through air or water in the direction of their axis, or if this axis is at rest, then moving the air or water in the opposite direction, therefore acting as a propeller, though as an effective propeller it is subject to improvements in design.

The center of gravity seems to be at the center of the circular axis, hence such rings revolve smoothly. By securing to the ring a shaft in the line of the axis, a top may be made which when spun at a low speed will show the vortex ring motion quite nicely.

## Fresh Discoveries Regarding Red Blood Corpuscles

SOME interesting observations on red blood corpuscles have been made by MM. von Liebermann and von Fillinger of Budapest, according to *Kosmos*, to the effect that many diseases which are not themselves, properly speaking, blood diseases, nevertheless produce injuries in these corpuscles, such injuries being observable in a salt solution, though not discernible under the microscope. They first made a suitable salt mixture in which the red corpuscles of a healthy man remained unaltered, one drop of the blood being placed in five cubic centimeters of the solution. This was verified with a number of healthy persons, and then tests were made with the blood of persons suffering from various diseases, among those mentioned being cancer, inflammation of the lungs, and inflammation of the breast. In all these cases the red blood corpuscles immediately dissolved, i. e., they gave up their red coloring matter to the solution. In other words, *hemolysis*, or dissolving of the blood, took place. The conclusion drawn is that probably in all diseases, and certainly in those named, the red blood corpuscles, though seeming quite sound when examined under the microscope, have in reality sustained alterations or injuries robbing them of their resisting power.

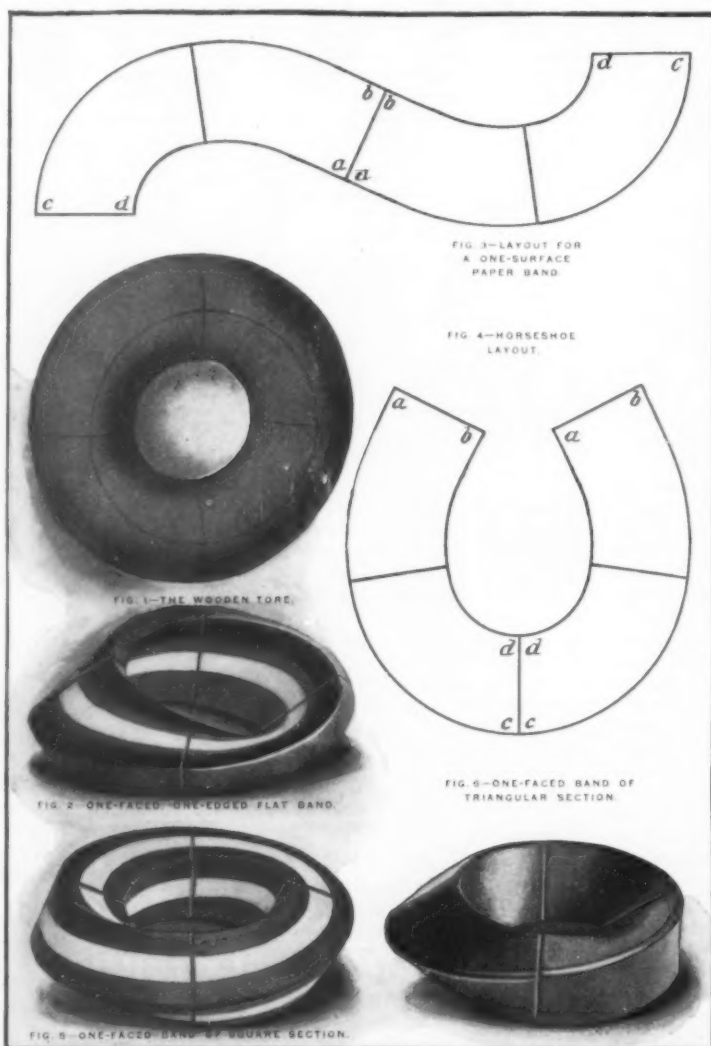
We must conceive that they have been poisoned by the virulent metabolic products which circulate in the blood of all diseased persons, and the fact that they were injured by such various diseases well illustrates the fact that the illness of any organ sympathetically affects the whole organism.

Another valuable observation was made in this connection. It was found that the injection of alcohol produced temporarily a similar effect on the red blood corpuscles. They were, in fact, poisoned by the alcohol for a time.

## The Theory of Gravity

IN an extremely interesting paper on this subject in the *Philosophical Magazine*, Prof. McLaren considers the universe as possessing four dimensions, and also retains the notion of time. The universe so considered is regarded as changeless, but not timeless, and differs in this respect from Minkowski's four dimensional universe. Prof. McLaren considers that throughout the universe there is but one ultimate substance. This substance has, however, two forms, "matter" and "ether," which are exclusive one of the other. Matter is a region where the fluid grows or decays. This theory strongly resembles that proposed long ago by Bernard Riemann. Prof. McLaren pleads for an unprejudiced examination of these views, revolutionary as they are, in view of the widespread feeling that there is something amiss with the classical mechanical theories of matter.

The Lighthouse Reservations on the Great Lakes are able to grow all the white cedar needed for spar buoys in their district.



Some curious single-surfaced, single-edged bands.

4) is perhaps the easier of the two to manipulate, as the curvature is then least at the joint.

A still more curious single surface ring is shown in Fig. 5. The cross section here is a square, as though made of a bar of square cross section, but instead of being given a half twist it is given only a quarter twist. At first sight it looks as though it should have four sides and four edges, but it has only one of each.

If cut lengthwise, dividing the square cross section into halves, it will be found necessary to cut twice around the circle, and it will then (if of flexible material) form one ring of four times the diameter and one quarter of the cross section. A round rubber ring can thus be split to form one four times as large. If the edge of the ring, Fig. 5, is cut off by a slanting cut, it will form a large ring while what remains will be a ring of the original diameter.

By making the section a regular hexagon, octagon, etc., and giving it a twist of one sixth, one eighth, etc., respectively, the ring will appear still more odd and deceiving, and if similarly cut, would form a ring six, eight, etc., times as large. The cross section of this form must of course be a regular polygon.

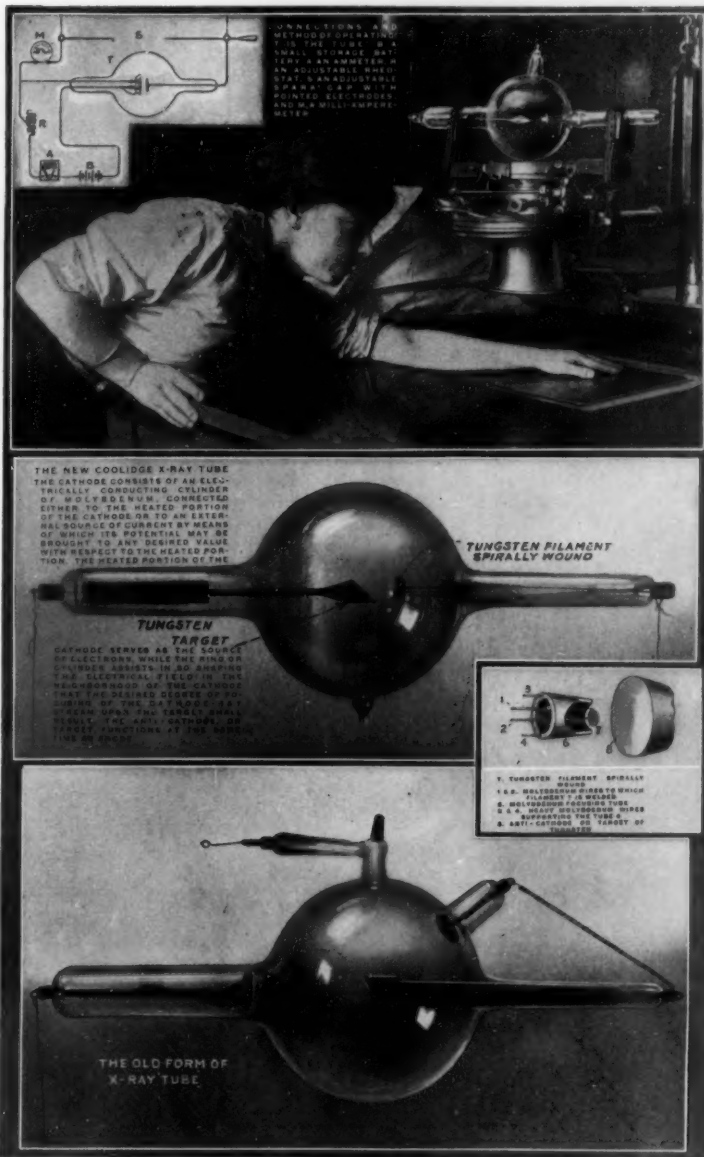
The one having a triangular section (Fig. 6) is of



### The U. S. Fleet Collier "Jupiter"

THE fleet collier "Jupiter" was authorized by Congress, May 13th, 1908; the keel was laid October 18th, 1911, and the ship went into commission April 7th, 1913. She was built in conformity with the rules of the American Bureau of Shipping. She is of twin-screw, single-deck type, and was designed for a speed of 14 knots with 5,500 shaft horse-power, on a draught of 27 feet 6 inches and a load displacement of 19,240 tons. She carries 11 officers and 148 men. The general dimensions of this large collier are: Length over all, 542 feet; beam, 65 feet; mean draught, 27 feet 6 inches.

She has four decks forward and five aft, the fore-castle and poop each being one deck higher than the upper deck. Amidship in the cargo space there is but one deck. There are nine water-tight, five oil-tight and two non-water-tight athwartship bulkheads. There are thirteen cargo holds. Those that may be used for oil are in pairs, one on each side of the ship, and they are divided by a fore-and-aft bulkhead. The holds that are used for coal extend only the width of the ship and are of the self-trimming type. The coal-handling gear calls for a delivery of 100 tons per bucket, per hour, when the gear is operated by a winchman with one week's experience. The booms and the rigging are supported from towers, each consisting of two A-frames tied together with X-braces. There are seven of these towers in the waist of the ship and one on the superstructure. There is a single A-crane between the two after towers, which serves as an additional support for the fore-and-aft trolley ways which run between towers 6 and 8. At each tower except towers 1 and 8 there are four booms, two on each side of the tower. The thwartship cable span, which acts as a track for the trolley, runs from a boom head on one side of the ship to a boom head on the other side, and the cable span gives a travel of twenty feet beyond each side of the ship, and has sufficient height to clear the deck of a battleship twenty feet above the collier's deck. There are two winches, one clam-shell bucket of one ton capacity, and a trolley for each pair of booms. The hoisting engine is twin-cylinder with a 10-inch diameter and 12-inch stroke; it runs in one direction only, and has a throttle operated by a foot lever. The trolley engine is twin-cylinder with 8½-inch diameter and 10-inch



A most important advance in the development of the X-Ray is the invention of a new Roentgen tube by Dr. Coolidge. As a result of the invention the time of exposure is reduced to but a fraction of what it has hitherto been. The tube is so flexible that it can be operated at a penetration so slight as to show the fine blood vessels of the hand or foot at one instant, while at the next it can be increased so that a penetration far exceeding anything possible with the ordinary tube can be secured.

The new high efficiency Coolidge X-Ray tube.

stroke; it has reversing links for changing the direction of rotation, and this is operated by a hand lever; the throttle being operated by a foot lever. Each bucket requires two men to operate it, one man to open and close and hoist and lower and another to traverse.

For filling and emptying the cargo holds with oil there are four 6-inch gate valves on the fore-castle and 6-inch wrought iron pipes which lead from these valves down through the fore-castle, where two on each side join into an 8-inch pipe, and these two 8-inch pipes in turn connect to a 10-inch riser which leads down into the pump room. In the pump room are two 14-inch by 12-inch by 12-inch horizontal duplex pumps, rated at 1,000 gallons per minute each.

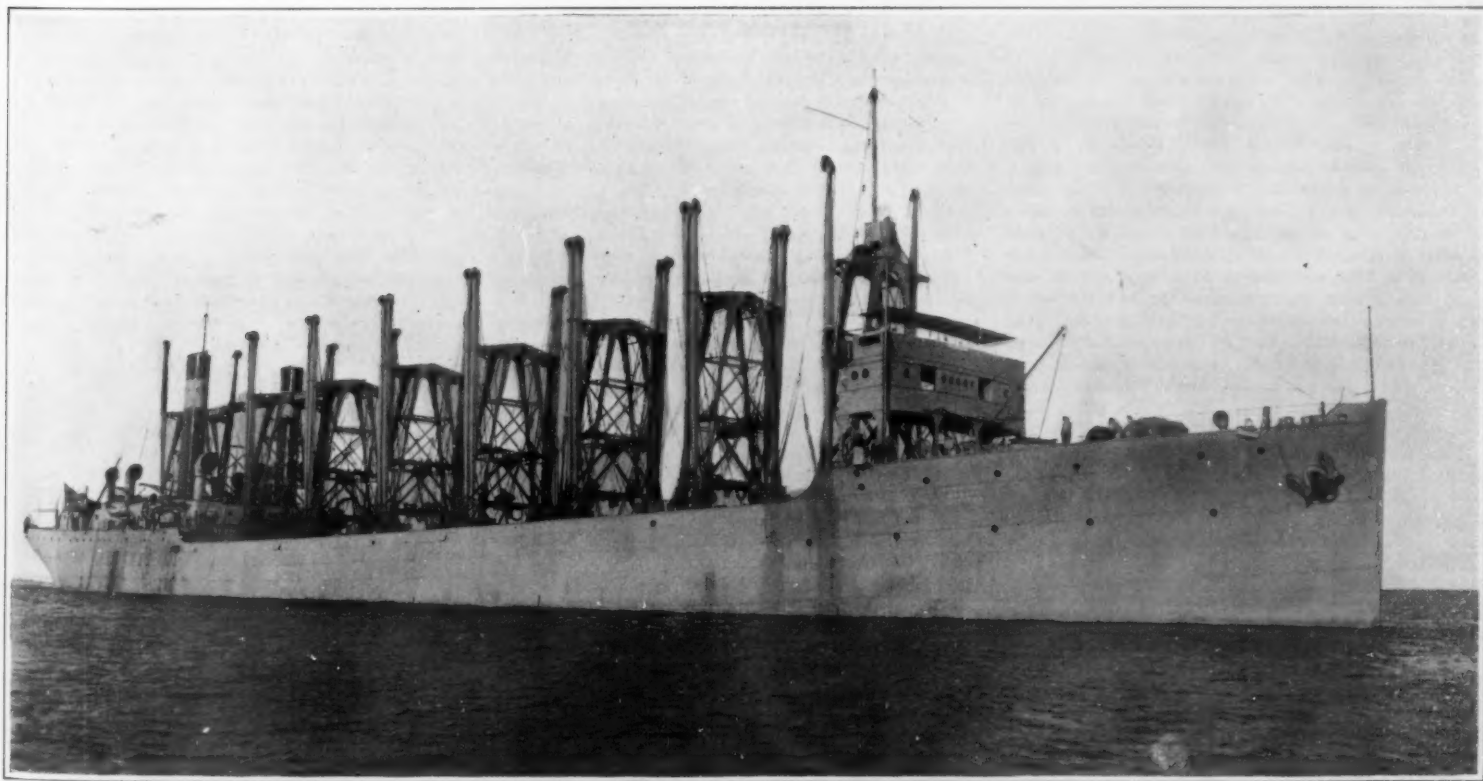
The main engines are of a new type, consisting of one Curtis turbo-generator, two induction motors, two water-cooled rheostats, and one main switchboard. The turbo-generator furnishes power for the motors, the function of the generators and motors being solely that of a reduction gear. All changes of speed are made by changing the speed of the turbine, thus varying the frequency of the generator, and consequently the speed of the motors. The speed reduction ratio is therefore 1 to 18. The object of this installation is to obtain the high efficiency of high-speed turbines and the high efficiency of low-speed propellers. The weight of the installation is less than that of the standard type of ship drive, and the space also is less than in any of the present installations of marine turbines or reciprocating engines.

### The New Coolidge Roentgen Ray Tube

By Herbert T. Wade

IN using the Roentgen ray tubes the penetration of the rays has hitherto been controlled by regulating the vacuum of the tube, and, except for minor details of construction and methods for such regulation of vacuum, there has been little fundamental difference in the tubes used. A new tube, however, designed by Dr. W. D. Coolidge, at the great research laboratories in Schenectady, has recently been developed in which an entirely new principle is involved. This tube gives a pure electron discharge and serves to reduce, in great measure, the actual time of exposure; in fact, it has been considered

(Continued on page 170.)



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The new United States fleet collier "Jupiter" has thirteen cargo holds to be used both for oil and coal. She is distinguished by her peculiar booms and rigging, supported from towers each consisting of two A-frames tied together with K-braces.

# Modern Hand-Grenades

## The Aasen Hand, Rifle and Mine Grenade

By Major H. Bannerman-Phillips

THE use of the "grenade" in modern warfare is a revival of an ancient practice, and the term was first used by DuBilley in reference to the siege of Arles in 1593. Until the end of the seventeenth century soldiers of the line were trained to throw grenades by hand, hence the name "grenadier." The grenades were hollow balls of iron or other metal, or annealed glass, about 2½ inches in diameter, filled with gun-powder and fired by a fuse which was lighted before throwing them. Soldiers of long service and acknowledged bravery were selected for grenadiers, of whom there were comparatively few in each regiment of infantry at first, though later there were grenadier companies, and still later the "grenadier company" of each battalion took priority on parade in both the English and French armies, though they no longer carried the little spherical projectiles which first gave them their name, and were mainly distinguishable by the height of the men, and their special uniform or head-dress.

Hand grenades were used to a large extent during the Russo-Japanese war, more particularly by both sides when fighting at close quarters during the assaults on the various forts at Port Arthur. The Japanese made them in the form of a small tin cylinder, about 8 inches long and 3 inches in diameter, filled with a high explosive and with about 7 inches of safety fuse projecting through a hole in the lid. This fuse being lighted before the grenade was thrown would allow about 9 seconds for the missile to reach its destination previous to exploding, but would not burn long enough to allow an enemy to pick it up when fallen and hurl it back before it had done its work. This was, in a manner, harking back to primitive methods, and any small closed tin receptacle would serve the same purpose if it were charged with gun-cotton or dynamite and a detonator and fuse attached in the usual way. The effect of these hand grenades when exploded in a confined space is sometimes very deadly. For instance, on one occasion a Russian guard of no less than seventeen men were killed inside a guard room by an improvised grenade, consisting of a fused slab of gun-cotton which was thrown through one of the windows.

So effective is this class of projectile when used under suitable conditions such as by storming parties on siege works or in small sorties by the besieged with the object of attacking sup-heads and approaches, that the Japanese found it necessary, when working in the trenches close to the enemy's line, to protect themselves by special wooden frames about 7 feet by 4 feet with stout wire netting projecting above the parapet. It is not to be wondered at therefore if inventors have endeavored of late years to produce grenades which while deadly to the enemy on explosion shall yet be capable of being safely handled by the thrower. The Aasen hand, rifle, and mine grenades are constructed to meet these conditions, as will be seen from the following particulars furnished by the manufacturers. Our cover illustrates both the rifle and howitzer form of the Aasen grenade. Of the illustrations on this page, Fig. 1 shows the manner in which a soldier carries hand grenades on his person; Fig. 2 is a picture of a volley of howitzer grenades, in which case the grenades are discharged from a fixed stand with various degrees of inclination to the horizon; and Fig. 3 pictures several types of grenades. In a recent number of the SCIENTIFIC AMERICAN, the Aasen mine grenade was described and illustrated—a bomb which is prevented from rising above a predetermined height by means of a chain secured in the ground, and electrically fired.

The methods and results of tests carried out with the various forms of weapon and projectile at a private practice range used by the inventor in Copenhagen in Denmark are shown as follows:

A. Volleys of rifle grenades were fired by 7 men from behind covers against a group of 80 double-figure targets of wood distributed under cover over an area of 900 square meters. Results of the first volley, as shown by numerals on the targets, 93 hits on 43 targets. After the third volley seventy-two targets showed

108 hits. The range varied between 300 and 400 meters.

The rifle grenade complete weighs about 550 grammes and contains 72 bullets each weighing 2.5 grammes and about 70 grammes of explosive. These 72 projectiles cover an area of at least 40 to 50 square meters. The rifle grenade can be used with an ordinary military rifle at all distances up to about 400 meters. The destructive efficiency of the grenade is due mainly to the fact that the interior percussion mechanism causes it to explode immediately on impact and before the grenade has time to bury itself in the ground.

B. Salvoes from seven "howitzers" were fired at a group of 80 figure targets placed within an area of about 900 square meters. The results of the first salvo are shown by numerals recording the hits on each target. After the fourth salvo 68 figure targets had received 143 hits between them. The distances varied between 280 and 310 meters. The grenades used were of type C, each weighing 1 kilogramme and containing 215 bullets and 200 grammes of explosive (Ecko). This C type can be thrown by hand up to 40 meters and with the "howitzer" or discharging tube up to 300 meters. The "howitzer" weighs 12 kilogrammes and can be carried in a special case as one would carry a rifle. The bullets cover an area of at least 80 square

face. At a distance of 10 meters they will pierce at least 100 millimeters of wood and will kill up to 50 meters. A hundred soldiers can lay out a protective line of these mine grenades 4,000 meters in length in less than two hours.

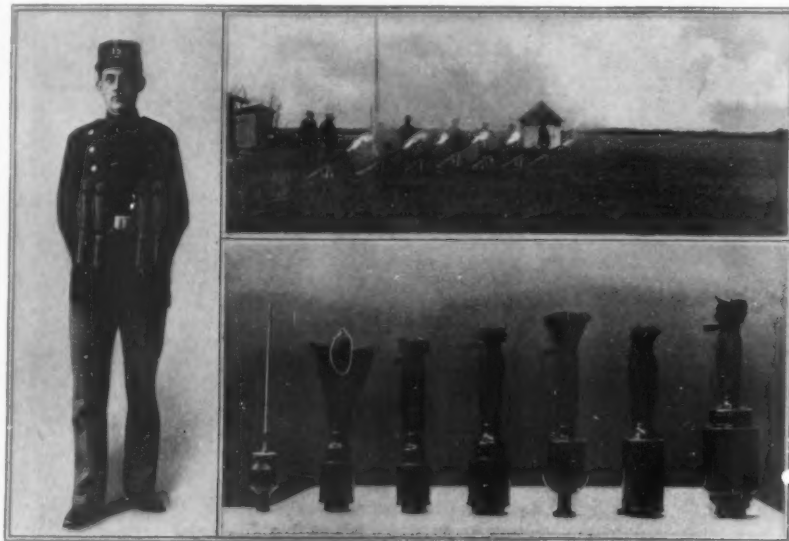
### The Recent Earthquake

AT this writing, a few days after the earthquake of February 10th, it is impossible to present more than a fragmentary account of the occurrence, or to be sure that much of the information now available on the subject is accurate. Even if the disturbance had been far more severe, entailing immense loss of life and property, we should be in much the same state of uncertainty. As matters now stand in this country, it is nobody's business in particular to collect and digest reports of earthquakes immediately after their occurrence, when all the facts are fresh in the observers' minds, and a high degree of accuracy in the record is therefore attainable. Seismographs are in operation at a few widely scattered points, but there is no systematic and prompt interchange of their records, analogous to the process of assembling meteorological observations by telegraph which has been brought to such perfection by the Weather Bureau. In short, the United States Seismological Service is still only a dream; just as the national weather service was for the far-seeing American scientists of half a century ago.

The earthquake in question occurred a little after half-past one o'clock in the afternoon. The seismograph at the American Museum of Natural History, in New York, registered preliminary tremors beginning at 1:33:5; the first well marked shock at 1:33:25; the maximum at 1:33:45; and trailers continually until about 1:35. The macroseism lasted hardly half a minute. Shocks perceptible to the human senses occurred in eastern Pennsylvania, New Jersey, New York State, New England, and lower eastern Canada. The epicenter appears to have been somewhere in the lower St. Lawrence Valley. So far as may be gathered from press dispatches, it cannot have been very distant from western and northern New York, where the disturbance reached an intensity of 6, or possibly 7, on the Rossi-Foré scale. At Binghamton, Penn Yan, and Syracuse walls were cracked, unstable objects were thrown about, and a mild panic occurred among the inhabitants. In Manhattan very few people were conscious of the shock, but it was distinctly perceptible in parts of Brooklyn, owing evidently to local instability of the soil. After-shocks were reported from New England on the 11th.

The whole phenomenon was one which would have attracted little attention if it had occurred in one of the great seismic belts of the earth. Happily macroseisms are rare in the eastern United States; though the presence of extensive fault-lines running practically the whole length of the Appalachian Valley, and northward makes it certain that perceptible and perhaps locally destructive earthquakes will occur in this comparatively favored part of the world from time to time in the future as they have in the past. Their effects will depend upon surface texture. The same intensity of impulse that wrought serious disaster in Charleston, S. C., in 1886, would probably leave New York city unscathed; the former town being built on soft and largely "made" land; the latter on thoroughly consolidated soil and rock.

**Mine Disasters in the United States.**—The statistics of coal-mine fatalities in the United States during last August, just published by the Bureau of Mines, show 230 deaths, as compared with 211 during the same month of 1912. During the first eight months of 1913, the fatalities numbered 1,673, as compared with 1,589 during the corresponding period of 1912. These shocking figures emphasize the importance of the humanitarian activities and investigations in which the Bureau of Mines has taken the lead.



1. Soldier equipped with hand grenades. 2. A volley of howitzer grenades. 3. Several types of grenades.

### Types of grenades to be used in modern warfare.

meters in the shape of a half-circle, and travel forward and sideways after the bursting of the grenade, but none are driven backward toward the thrower. These grenades are consequently of great value for fighting at close quarters. They are so constructed as to be secure from bursting until they have traveled at least 8 meters on their way toward the target.

C. A single volley of 7 hand grenades, namely, 3 of type A1 and 4 of type C, thrown by hand from behind covers at the targets shown in sketch. Result: 119 hits on 33 targets as shown by the numerals on the latter. The hand grenade, type A1, weighs about 1 kilogramme, contains 190 bullets of 2.4 grammes each and a charge of 110 grammes of explosive (Ecko). The percussion mechanism and safety arrangements are similar to type C, but the bullets fly in all directions on the bursting of the grenade, consequently it is only suitable for throwing from behind cover.

D. Three mine grenades were buried underground in a triangle at 30 meters interval in the midst of a group of about 145 double-figure targets of wood, which were distributed over an area of about 2,700 square meters. The grenades were fired singly, one after the other (by electricity), and the results were about 700 hits among 120 targets, as shown by numerals.

The mine grenade weighs about 4 kilogrammes and contains 400 projectiles each weighing 3.3 grammes and 200 grammes of explosive (Ecko). The 400 projectiles cover a beaten zone of at least 800 square meters. The grenades are buried about half a meter underground, together with the electrical connections, so that they are absolutely invisible to an enemy. On being fired they rise about three fourths of a meter above ground before bursting and their projectiles are then driven in all directions parallel to the ground sur-



### The Value of Radium

TO scientific men radium has been a subject of absorbing discussion from the moment it was discovered, but it is rapidly becoming a matter of considerable interest to the general public on account of its therapeutic value. Its extreme rarity and the mysterious and not yet wholly understood qualities and activities which are peculiar to it, added to the enormous difficulty in obtaining even small quantities of the precious metal, and the extraordinary prices quoted for it when obtained, invest the subject with a glamor which appeals to the romantic side of human nature. Consequently, every fact concerning radium, and every fresh development of our knowledge of its properties, are noted with intelligent curiosity by the great majority of newspaper readers, to whom chemistry is a closed book and physics a matter of no concern.

Its recent effects in the treatment of cancer have called forth manifestations of world-wide satisfaction, and "radium water" is now being tried for the treatment of gout and rheumatism. This is the ordinary fluid known to chemists as  $H_2O$ , and to the layman as simply "water," but it is charged with the emanation, or gas given off by radium in the form of radium salts. The method of preparation is to dissolve the salts in water, which is then sealed up and left for about 23 days, during which the emanation is produced. It can then be expelled by boiling and passed into another measure of water, endowing the latter with radio-active qualities. Unfortunately, this radio-activity only endures for a short time, and in 96 hours, or thereabout, the preparation has diminished in efficiency by more than fifty per cent. Water with a certain amount of inherent radio-activity can be obtained from springs, and dust with the same characteristics is also found in certain localities. In those cases the water must be drunk fresh from the spring, but the dust appears to retain its curative quality as a dressing for wounds or otherwise therapeutically, in the form of plasters and poultices, for a considerable time after removal from the spot where it is found and when it has been subjected to the influence of radium in the ordinary course of nature. In Great Britain, and presumably elsewhere, the usual course adopted in treatment of disease by radium water is to make up for the diminishing effect by increasing the quantity taken as the treatment proceeds, and as the water prepared thus is producible at a cost which is infinitesimal as compared with that of radium itself, it promises, if successful, to be a boon to suffering humanity.

It is to be hoped that as our knowledge of the effects of radium on cancer increases we may find some cheaper method of extracting it from the substances which contain it, for at present the cost of the process is simply prohibitive. So far it has been found in pitch-blende, autunite, carnotite and torbenite, owing to their containing small quantities of the metal uranium, which itself contains the much sought-for radium in the proportion of 1/3,000,000.

A ton of the ore above referred to will contain some ten milligrammes of radium and Madame Curie's standard sample contains twenty-two milligrammes of pure radium chloride. European transactions in this valuable product usually include an agreement providing that the article delivered shall be compared with the standard at Sévres or the analogous standard at Vienna in the keeping of the Austrian Academy of Sciences.

The current market value of radium in Europe at the present moment works out at somewhere about \$2,500,000 per ounce—not that any individual or corporate society is fortunate enough to be in possession of such a quantity.

### How a Cream Separator Speed Indicator Saves Money

"THERE! If you've been turning your separator at that speed all the time, then with your twenty cows you've lost \$524.10 worth of butter in one year!"

The above is the astounding statement made by a dairyming authority to a farmer whom he had been watching operating his cream separator.

When you buy a cream separator you will find on the crank handle, in large, raised letters instructions something like this—"55 revolutions per minute." Or it may read 45, or 50, or 60; it varies on the different makes of separators.

Suppose, for example, that yours reads "55 revolutions per minute." What does that mean? It means, whenever you operate that cream separator you should turn the crank handle precisely 55 turns to the minute.

The manufacturer has tested his separator under every possible condition, in order to know the exact method of operation at which it gives the greatest degree of efficiency.

But how does the dairyman know how many times he turns it? It is just as impossible to guess accurately the speed of his cream separator as it is to guess accurately at other things.

At a first-class dairy farm the superintendent said

he always "guessed" the proper speed. When asked how his helpers operated the separator he replied that, after he had broken new men in, they also could operate it at approximately correct speed. In order to prove his statement, one of his helpers was asked to turn the separator at the speed he usually operated it. The number on the crank handle read "48 revolutions per minute." But the helper made only 28 turns to the minute.

This proved how absolutely wrong the superintendent was in supposing that he, or any of his helpers, could tell when they were turning the crank handle exactly right, or anywhere near, what the manufacturer told them it should be turned. Here were pounds of butter-fat going to the hogs daily, just because he "guessed." And if he will feed calves and hogs with butter-fat worth 30 cents a pound, when he can feed them better on two and one half pounds of corn meal and skim milk, then that shows how much the dairymen have to learn to get all the profits out of dairyming and farming.

At the Purdue Experiment Station, Indiana, very exhaustive tests were carried on to show the tremendous losses through wrong operation of cream separators. A separator was run at its normal speed of 55 turns to the crank handle per minute. Fifty pounds of milk were run through the separator. At this speed, it delivered 45 pounds of skim milk and 5 pounds of cream. This cream tested 2.11 pounds of butter-fat. When the speed was increased to 75 turns per minute, the skim milk discharged was 46½ pounds, reducing the cream to 3½ pounds. And the amount of butter-fat was slightly less than when the separator was turned at normal speed.

Next, a test was made by letting the speed of the machine drop down to that at which it has been found the average dairymen operates a cream separator, with the astonishing result that the discharge from the "cream" spout went up to 9½ pounds, but it tested only 11 per cent of butter-fat—only 1.04 pounds of fat out of 50 pounds of milk, as against 2.11 pounds when the separator was operated correctly.

Dairymen are losing from 20 to 50 per cent of their butter-fat with every operation. This is a matter of waste that is simply appalling when the aggregate figures of all the dairymen in this country are considered. It probably runs into thousands of dollars with each daily milking.

Now a speed indicator has been invented to be applied to cream separators, mounted on the crank shaft of the separator. As the separator handle is turned, the exact number of revolutions per minute that the crank handle is making is shown in a definite figure, so that it may be read at a glance. There is no calculating to be done; it is only necessary to keep on turning the crank handle until the proper speed is reached, and then continue at that exact speed throughout the separation. This eliminates all guess-work entirely. It also adds zest to the otherwise monotonous operation, particularly where the separation requires upward of an hour's turning, as it does in many instances.

### Is the Earth Drying Up?

IN a recent paper before the Royal Geographical Society Prof. Gregory discusses this question. It is believed by many that there is a progressive world-wide change toward a greater and greater degree of dryness. Prof. Ellsworth Huntington believes that there are alternations of climate, it being sometimes drier, sometimes moister, but with a tendency to become generally drier. Mr. R. Thirlmere believes that the climatic changes take place in cycles, each cycle lasting 2,000 years or more, and that our world is at present cooling. From an exhaustive analysis of the evidence Prof. Gregory doubts the theory of a universal tendency toward drought, although there may be local variations. The strongest evidence for the desiccation theory is derived from Central Asia, the majority of travelers who have visited that region being convinced of its progressive change to a state of greater and greater dryness.

**Absorption of Light in Space.**—If one divides the known nebulae in groups according to the dimensions of their apparent diameters and one also notes their intrinsic brightness, it is clear that their apparent diameters should decrease as the distance increases. Their brightness, on the other hand, will diminish with increasing distance only if interstellar space absorbs light. As the result of a great number of observations a correlation between brightness and apparent diameter has been observed, and is so marked that it is impossible to put it down to chance or to some systematic error. It appears that there is a real absorption in space, and if more precise descriptions of the nebulae were available the law of absorption could be assigned. Another indication in the same direction is that the mean brightness of the nebulae varies from one part of the heavens to another in a marked manner and in the same way as the stellar density.

## Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

### A Problem in United States Coins

To the Editor of the SCIENTIFIC AMERICAN:

Permit me to offer the following solution to the problem submitted by Theodore L. DeLand in the SCIENTIFIC AMERICAN of February 7th, on page 117, and entitled "A Problem in United States Coins." I have not yet thought of an algebraic formula by which the problem could be solved, but have reasoned it out by a process of elimination.

The highest common factor of 200, the number of coins, and 50,000, the value of those coins in cents, without making the resulting quotient approximately equal to or less than the number of different kinds of coins, which would be absurd, is 10. The resulting quotients are 20 (coins) and 5,000 (cents). Hence, if twenty coins can be found, subject to the condition stated, whose combined values are 5,000 cents, it will only be necessary to multiply the number and the value of each kind by 10 and add the resulting similar products to get 200 coins and \$500 for the final result.

Considering only the four gold coins now minted, there are only ten possible combinations in which the values are less than 5,000 cents. If the number of coins in each combination be subtracted from 20 and their value from 5,000, it will be found that four of the possible ten combinations can be eliminated, because if all the coins in each case were fifty-cent pieces, the largest coin now left to be considered, their combined values would not be as large as the required value in the given combination. Therefore, only the following six possible combinations remain to be considered:

No. of coins.	Value in cents.	No. of coins.	Value in cents.
15	250	14	500
15	500	13	500
15	750	13	250

By the same line of reasoning I took up each of the above combinations separately, and from the 15 to 250 one derived a 10 to 50 combination in which only dimes, nickels and cents had not yet been considered—4 dimes, 1 nickel and 5 cents make such a combination. Working back through the proper combination, I found that I had used 5 cents, 1 nickel, 4 tens, 2 quarters, 3 fifties, 1 (\$2.50), 1 (\$5), 2 (\$10), and 1 (\$20).

Multiplying by 10 as determined in the second paragraph above, I summed up as follows:

50 cents	.....	\$0.50
10 nickels	.....	.50
40 tens	.....	4.00
20 quarters	.....	5.00
30 fifties	.....	15.00
10 (\$2.50)	.....	25.00
10 (\$5)	.....	50.00
20 (\$10)	.....	200.00
10 (\$20)	.....	200.00
200 coins	.....	\$500.00

Ithaca, N. Y.

EDWARD D. ARNOLD,  
Teacher of Physics.

### Snow Rollers

To the Editor of the SCIENTIFIC AMERICAN:

About a year ago I wrote you concerning some "Snow Rollers" which had formed on our lawn at Potsdam, N. Y. The article was published and caused a little comment at the time. I thought it might be of interest that the "rollers" have again made their appearance, in the same place, though in smaller numbers. It is a curious fact that in no previous year has this phenomenon been observed here, and now it has appeared twice in succession.

Middletown, N. Y.

T. J. MOON.

### The Salving of Submarines

To the Editor of the SCIENTIFIC AMERICAN:

The daily press records the sinking of a submarine of the navy of Great Britain; and the fact that no provision is or has thus far been made for supplies while a boat is submerged, leads me to suggest the idea that comes to my mind in connection.

Were a length of hose contained in the submarine boat to pass through a hole in the top provided for the purpose, and the hose end connected with apparatus lighter than water, would it not be possible to—

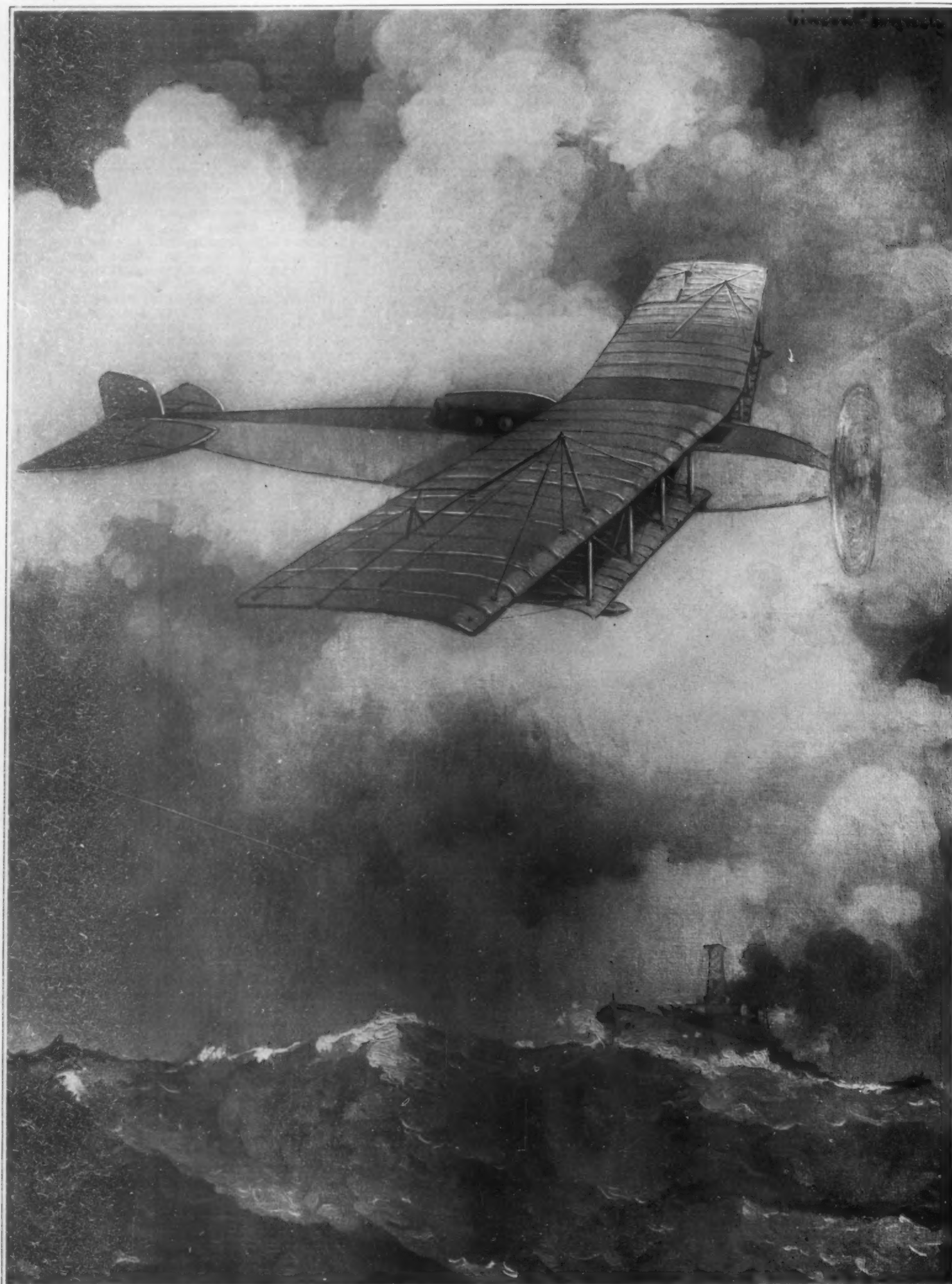
1. Know the exact location of the submerged craft?  
2. To keep the occupants imprisoned therein supplied with air and other necessities of life?

Then also if protruding hooks or bolts were fastened to the outside of the boat would it not be a provision that would tend to effect the raising of the structure submerged?

Hamden, Conn.

ROLAND C. FINLEY.

Mr. Rodman Wanamaker of Philadelphia has decided to build a machine which will compete for the prize of \$50,000 offered by Lord Northcliffe for the first crossing of the Atlantic Ocean in an aeroplane. The building of the machine will be intrusted to Mr. Glenn H. Curtiss, who has decided that the prize can be won in a flight of a single stage lasting not more than fifteen hours. The machine will have the general appearance here shown, and will be equipped with a motor of two hundred horse-power, which Mr. Curtiss is now testing.



General appearance of the Wanamaker-Curtiss biplane, in which an English and an American pilot will attempt to cross the Atlantic Ocean early during the present summer.



### The Wanamaker-Curtiss Transatlantic Biplane

A VERY serious attempt is to be made during the course of the early summer to cross the Atlantic Ocean in a flying machine. Mr. Rodman Wanamaker of Philadelphia in a letter sent to the Aero Club of America, announces that he has commissioned Mr. Glenn H. Curtiss to construct a flying boat capable of making the trip across the Atlantic Ocean in a single flight of from twelve to fifteen hours.

So very little information has been given out as to the design of the aircraft in which this feat will be attempted that it is impossible to offer anything in the nature of critical comment. Mr. Curtiss has stated, however, that "for reasons not at all in accordance with those usually given for such a procedure a tractor screw in front of the machine will be used instead of the pro-

tons, in other words sufficiently ample to provide for the enormous amount of fuel which must be carried. In outline the wings will be swept back at an angle of some six degrees. They will have a dihedral angle, rising from the center to the extremities to insure a certain amount of inherent stability.

Naturally everything hinges on the motor.

Up to the present time a 200 horse-power motor has not been mounted on a flying boat. To be sure Sikorsky has built four units of 100 horse-power each into his enormous machine. This, however, is not quite the same as concentrating 200 horse-power in the bow of a biplane. Even if the transatlantic flight proves a failure as a voyage, the experiment that Mr. Wanamaker is making deserves encouragement because for the first time light will be thrown upon the engine power required for large machines and on the behavior

### Flying Around the World

THE ideal preliminary conditions of an aeroplane trip around the world such as the Panama Pacific Exposition authorities seek to encourage, include a thorough study of the portions of the proposed route not already aeronautically well known, the compilation of special maps and instructions, and, of course, the establishment of suitably equipped and provisioned landing places. It is passing strange that while the promoters of the race announce that a fund of \$300,000 and possibly \$500,000 (there is even talk of one million dollars) will be available for prizes, no provision appears to have been made for the equally important preliminary expenses of the undertaking.

It is impossible to estimate with any degree of accuracy what these preliminary expenses will be. Certainly there can be no haphazard start from San Fran-



One of the possible routes for circumnavigating the globe in a flying machine.

pellor usually seen in Curtiss flying boats." The hull will be of torpedo or streamline form of large diameter, almost entirely inclosed, so that in case of a forced "landing" in mid-ocean it can be relied upon to float for days. In the bow will be installed a motor of approximately 200 horse-power, readily accessible to the two operators. Twelve feet back of the motor will be the cockpit proper, and in it there will be room for the two men to sit down or move about. The controls will be in duplicate so that the machine may be handled by both men in unison, or by either one.

The wings will have a span of about eighty feet and the area of lifting surface will be about 1,200 square feet. The latest wings designed by Mr. Curtiss are able to rise from the water with a load of ten pounds to the square foot. Hence the actual lifting capacity of the Wanamaker transatlantic flying boat will be several

of very large engines in a regularly sustained flight.

The recent flight of Ingold, who covered a distance of about 1,000 miles in 16 hours, as well as the record flight of Victor Stöfler, who covered 1,340 miles in 24 hours, would seem to argue that given a perfect motor it is not utterly impossible to cross the Atlantic in 15 hours, in a single flight from dawn to dusk.

It may be questioned, however, whether Mr. Curtiss' expressed intention of having the machine fly at an altitude of 10,000 feet will be realized. The men who have made record altitudes testify to the difficulty of securing good motor compression at heights of 10,000 feet and over. Whatever may be the advantage to be gained by constant winds at that height, will be more than offset by imposing upon a brand new type of motor a difficulty with which even the tried engines of record breakers find it hard to cope.

else without a very careful plotting of the most desirable course. It may be that the aero clubs of the world will co-operate in mapping the routes for their own countries. But who will map out the routes over eastern Asia, the uninhabited islands that lie north of Japan, the bleak archipelago that spans the sea between Asia and North America, not to mention the all but unexplored wilderness in the heart of Alaska? The sum of \$300,000 which has been set aside for prizes would in itself be hardly sufficient to meet the expenses of making the necessary preliminary explorations.

Consider also the necessity of landing places. How many shall there be? Assuming that the globe will be circumnavigated in stages of 600 miles there would have to be at least forty stations. By station we mean not merely a shed into which a machine can be run and housed for the night, but a depot for fuel and for the

making of repairs. At least two men—skilled mechanics—must be assigned to each station. The cost of building the stations and of paying the salaries of the mechanics while they are on duty would amount easily to \$1,500 for each station, in other words, \$30,000. Add to this \$50,000, the cost of building a machine strong and powerful enough to withstand the severe strain of such a tremendous trial (at least this much, it has been estimated, must be expended merely to cross the Atlantic) and the ambitious aviator must spend at least \$410,000 in order to win a paltry \$100,000 first prize.

It is estimated that the distance which it would be necessary to cover would amount to about 22,000 miles. Assuming that the prize of \$100,000 can be won, the successful aviator will have earned about \$5 a mile. Mr. Grahame-White, whom Americans will remember as one of the participants in the Belmont Park meeting of 1910 as well as in flights at Boston in the same year and who, as many Americans can testify, knows how to charge for passenger flights, has stated in the press that his aviators at Hendon, England, are earning more than that per mile now.

The time of ninety days allotted for the completion of the globe circuit seems extremely short in view of past performances. Vedrines consumed some weeks in accomplishing the 3,500-mile journey from Paris to the Pyramids. Skillful aviator as he is, he flew on an average of only 100 miles a day. On the other hand, Brindejone des Moulinais covered 3,002 miles in eight days in flying from Paris to Warsaw and St. Petersburg and back. Vedrines' performance, however, is a more exact parallel to one of the stages in a globe circling flight. He traveled over partly uncivilized countries, at great personal risk, whereas des Moulinais flew over civilized Europe after elaborate preparations had been made. Yet successful as he was, Brindejone des Moulinais is quoted as saying: "The crossing of the Atlantic alone by any route or any system is impossible now, and probably will be for some time to come. I doubt personally whether any pilot could stand the strain of a flight from Paris to New York even if he took his time about it."

In flying to Constantinople Vedrines was shot at by ignorant peasants. What would happen to an aviator who was compelled to land in the wilds of eastern Asia or on one of the sparsely populated Kurile Islands?

The art of aeronautical mapping has made much progress. The "international aeronautical chart," which will ultimately commensurate the globe, is still in embryo, but plans for its construction have been matured by a committee of the International Aeronautic Federation. In the aeronautic charts of the Aero Club of France we already have an admirable model for the technical details of such publications. In the time available before the race it seems hardly possible to prepare special maps of the whole route. Where suitable *points de repère* do not already exist they must be erected.

Let us suppose, however, that the facilities at the command of the contestants, apart from the possession of larger aeroplanes and more powerful motors, and the presence of specially arranged landing and provisioning places at points where they are absolutely necessary, will not be superior to those enjoyed by Garros in his last trans-Mediterranean flight, or by Vedrines in his trip from Paris to Cairo. What will be the special difficulties of a flight around the world? The mere distance—some 22,000 miles—is probably not one of them. In the last Michelin Cup contest Helen, a French pilot, made daily cross-country flights on 30 consecutive days, aggregating 10,000 miles. The conditions of this test forbade repairs to the motor or the renewal of any parts. Helen averaged 330 miles a day; but the "record" flight in 24 hours is Victor Stoffer's of 1,340 miles. These figures encourage the belief that the requirements of the 'round-the-world flight—22,000 miles to be made in 90 days—seem not unreasonable. The race is planned for the months of May, June, and July. At that season the contestants will enjoy the advantage of continuous daylight over a considerable part of their route. North of about latitude 55 degrees there is no true night within a month or so of the summer solstice.

The length of the flights over water has been urged as the main difficulty. The longest lap of this character will be from southern Greenland to Iceland—say 670 miles. With no fuss of preparation, and with a bulky motor, Roland Garros recently flew 450 miles over the Mediterranean, from St. Raphael to Bizerta. Will not the aviators of 1914-15 better this record in the ordinary course of events?

So far we have ignored climatic and topographic conditions, and these we may now consider together. The question of temperature, in its effects on motors and men, is unimportant. It will be more a question of altitude than latitude in the coming contest, just as it is in the flights of everyday routine. An editorial on the race in the New York *Sun* probably reflects popular opinion in assuming that because Greenland and Iceland are included in the route the aviators will necessarily

experience the rigors of a polar climate, but this is a fallacy. It is most misleading to compare Nansen's crossing of the Greenland ice-cap, as the editorial in question has done, with a momentary summer visit to Cape Farewell.

The general drift of the winds around the globe is decidedly favorable to the flight, which is to be from west to east, the direction of the great circumpolar whirl.

The journey from San Francisco across the American continent requires little comment. The aviators will naturally keep in touch with the Weather Bureau, in order to take advantage of the favorable and avoid the unfavorable quadrants of cyclonic wind-systems. A crucial stage of the undertaking will be reached when the contestants set out from Belle Isle on the long flight to Greenland. Here the great—the almost insuperable—difficulty is fog. Statistics gathered at Belle Isle show an average of 10 days with fog in May, 17 in June, and 22 in July. Notwithstanding the fact that the notorious fogs of the Grand Banks lie to the south, the probability of foggy weather anywhere between Belle Isle and Cape Farewell during the summer months is very great. How this difficulty is to be solved, save by sheer luck, we are not prepared to suggest.

Ice is apt to be abundant off the coast of Cape Farewell, but the shore itself is free from ice and snow in summer and offers no serious obstacle to landing. The Eskimo population is extremely sparse, the nearest important settlement, Julianehaab, being 110 miles farther north. Presumably a regular landing station will be established at Cape Farewell, so that this consideration is unimportant.

The winds of the northern Atlantic Ocean are dominated by a quasi-permanent area of low barometric pressure—the so-called "Iceland low." The circulation around this "low," very active in winter, is comparatively sluggish in summer. The cyclonic storms which so frequently pass around the world from west to east in middle latitudes rarely run as far north as Greenland and Iceland, especially in summer. Local storms and squalls occur, but on the whole the wind conditions are not likely to prove a more dangerous feature of the Atlantic crossing than they would in a journey of similar length anywhere else in the world outside of the tropical and subtropical zones.

The next stage of the journey takes the aeronaut to Iceland. It fortunately happens that the west coast of Iceland is strikingly free from fog, owing to the fact that the ocean temperature in that region is always higher than the air temperature. At Stykkisholm there are only 6 days with fog in the year, on an average. On the eastern coast the conditions are reversed; Papey has 174 foggy days annually. Snow and ice rarely occur on the south and west coast in summers. The temperature sometimes rises at midday above 85 deg. Fahr., and the atmosphere is remarkably clear.

The next lap carries the aviator to the Hebrides and into the zone of occasional cyclonic storms. Fog occurs in the Hebrides one day in ten, and upward, during June. The journey through the British Isles to Paris, and thence to Berlin, Warsaw, St. Petersburg, and Moscow is all plain sailing—as aeroplane journeys go. The same may probably be said of the long stretch from Moscow to Vladivostok, where the trail is well blazed by the trans-Siberian Railway, and the climatic conditions are rather similar, except for somewhat cooler nights, to those that prevail in the interior of the United States in summer. The Urals and other mountains must be crossed, but such feats are now commonplace. The route is then across the sea to Korea, over the Japan Sea to Kobe, and thence northeastward by a truly formidable journey, *via* the Kurile Islands and Kamchatka, to Cape Deshenev (East Cape), and across Bering Strait to Alaska.

As soon as the Pacific seaboard of Asia is reached the aviator again encounters the fog problem, and this will haunt him more or less persistently until he reaches (if he ever does) the notoriously foggy bay of San Francisco. The entire coast of the Maritime Province of Siberia, including Kamchatka, is a region of dense and frequent fogs in summer, and the same is true of the Kurile Islands. Severe gales are said to be frequent in the Kuriles, but the fact is that very little is known about these islands, most of which have no permanent inhabitants and have never been explored. In Kamchatka the aviator has the alternatives of following a known coast-line, almost constantly shrouded in fog, or flying over a little-known interior, where there are no roads or settlements and a very sparse population of primitive inhabitants. The natural stopping-place in Kamchatka will be Petropavlovsk, the capital; a sleepy fur-trading village of 400 people. The region north of Kamchatka is even more desolate and forbidding. About the only saving grace of northeastern Asia from the aeronautical point of view is that the Russian government now maintains some powerful wireless telegraph stations in that quarter. All in all, the flight from Japan to Cape Deshenev appears to be the *crux* of the whole undertaking, and its feasibility

in the present generation is certainly highly questionable.

A journey down the long Alaskan coast would again be attended by besetting fogs, varied with drenching rain-storms. These may, however, be avoided by flying well inland, where there are probably enough settlements and the country is sufficiently well mapped to make the trip feasible. The rest of the flight to San Francisco—after the stupendous feats that have gone before—may be taken for granted.

### A \$30,000 International Railroad Competition

UNDER a decree of the Ministry of Railroads, dated February 25th, 1913, the Chilean Government has called for an International Competition for Plans and Specifications for one central model workshop and four repair shops for the State Railways of Chile.

The bases of the contest are as follows:

1. A first prize of \$20,000 for the best plan and a second prize of \$10,000 for the next best. Honorary mentions will be awarded also. The money prizes shall be awarded only to plans for the central workshop.

2. The plans and specifications should be received at the Ministry of Railroads (Ministerio de Ferrocarriles, Santiago, Chile) not later than May 1st, 1914.

3. A Jury of Award composed of nine members appointed by the government and presided over by the Minister of Railroads, shall examine and pass upon the plans and specifications submitted, and report thereon within one month from the closing of the competition.

4. The prizes shall be paid within 30 days from the date of the jury's report.

5. The government of Chile reserves the right to reject any or all of the plans submitted, and consequently to withhold any or all of the prizes.

6. Plans and specifications to which prizes shall have been awarded shall become the property of the government, and all others are to be returned to their authors.

7. The fundamental requirements of the central workshop are as follows:

a. A capacity for repairing 500 locomotives with tenders per year, provided that no large repair work shall take more than from 60 to 90 days of eight and one half working hours. (An example of a large repair work would be the changing of cylinders and boilers, and their accessories.)

b. A capacity for the simultaneous and continuous repair of 50 passenger coaches and 400 freight cars.

(The present number of locomotives in operation is 600; of passenger cars, 500; and of freight cars, 6,000. These figures are to be increased yearly, as follows: Coaches and cars, 10 per cent; and locomotives, 5 per cent.)

c. It should be so equipped as to meet all the needs of the general service, its administrative organization, and the machinery and plants.

d. A capacity for producing not only the necessary pieces and parts, such as cylinders, boilers and mechanisms, but also such pieces as may be needed in the auxiliary repair shops.

e. Adequate stores for the stocking of reserve materials.

8. The central workshop may be presented in the plans as one plant to be built on a single site, or as two separate plants, one for locomotives and tenders, and the other for coaches and cars.

9. As to the auxiliary repair shops, their capacity or importance shall be determined by each competitor, taking as a basis the central workshop and bearing in mind the requirements of the service and traffic.

10. In drawing up these plans and specifications, the following facts should be taken into consideration;

a. That the necessary sites are to be furnished by the government without cost.

b. That native materials shall be used in so far as possible.

c. That prices of materials and machinery are to be estimated as placed on board at Valparaiso, and, therefore, not including customs duties.

d. That the State Railways will transport without charge all materials, but the cost of loading and unloading should be included in the estimates.

11. The government of Chile will furnish all available data and render all possible help for the drawing up of these plans and specifications, provided, however, that the competitor desiring such data or help shall have a duly authorized representative in Chile, who, on his behalf, shall express in writing his purpose to take part in the contest under these bases, and designate the persons who as experts are to undertake the studies in the country.

12. It is provided that this is exclusively a competition for plans and specifications, and that the government shall not incur any obligation as to the future construction of the works.

There are 36,500,000 young trees in the Government's forest nurseries.



# An Organ on Which Color Compositions Are Played

## The New Art of Color Music and Its Mechanism

By John W. N. Sullivan

IN popular thought there is a well-marked line of demarcation between the Arts and the Sciences. But even a cursory examination reveals the fact that these two branches of human activity are in many cases closely connected. It is even true that some arts could not exist at all without the previous acquisition of a considerable body of scientific knowledge. The new art of cinematography is a case in point, and everyone is aware that the modern pianoforte is the result of a long development, a consequence of the increasing application of scientific principles to its construction. One of the most interesting examples of the reaction of Science upon Art is the new art of Color Music. In presenting this subject to the reader it is advisable to start with its analogy to Music, although, as we shall see, this analogy is not to be pushed to extremes. Both sound and color are vibratory phenomena, sound being due to vibrations of the air, and color to vibrations of the ether. Two notes of different pitch correspond to different rates of vibration, the higher note corresponding to a faster rate of vibration in such a way that doubling the rate of vibration raises the pitch of the note by an octave. The basis of the musical scale is the octave. Now if we examine light rays of different colors we should find that their rates of vibration are different. The light rays which correspond to the color violet are vibrating at almost twice the rate of the light rays corresponding to the color red. Color in light is analogous to pitch and sound. In the spectrum, which we obtain by decomposing white light by means of a prism, the colors range from red at one end to violet at the other, the intermediate colors corresponding to intermediate rates of vibration. It cannot fail to strike the reader that we have here a close analogy with the musical octave. On this basis we may find an explanation of the fact that certain combinations of colors are regarded as harmonious, whereas other combinations produce an intolerable sense of discord. So far we are on familiar ground. We are dealing with the statics of the subject, as it were. But while combinations of sounds are analogous to combinations of color, a musical composition is differentiated from a painting by the introduction of the time element. Music possesses the additional element of rhythm. It is Prof. Rimington's chief claim to distinction in this connection that he has imported this element also into color, thus giving rise to a new and beautiful art, the art of Mobile Color or Color Music.

Rimington bases his work in this subject upon two indisputable psychological facts: Firstly, different successions of color, different color sequences, give rise to different sensations in the observer; and secondly, the rhythmic succession of these colors is of as much importance as the rhythmic succession of notes in a musical composition. Undoubtedly the best way of enabling the reader to realize the truth of these assertions would be to enable him to be present at the performance of a color composition; but as that is at present impossible, we must have recourse to describing a color composition in words. We cannot do better than quote from Prof. Rimington's book "Colour Music."

"Imagine a darkened concert-room. At one end there is a large screen of white drapery in folds surrounded with black and framed by two bands of pure white light. Upon this we will suppose, as an example of a simple colour composition, that there appears the faintest possible flush of rose colour, which very gradually fades away while we are enjoying its purity and subtlety of tint, and we return to darkness. Then, with an interval, it is repeated in three successive phases, the last of which is stronger and more prolonged.

"While it is still lingering upon the screen a rapid series of touches of pale lavender notes of colour begin to flit across it, gradually strengthening into deep violet. This again becomes shot with amethyst, and afterward, changing gradually into a broken tint of ruby, gives a return to the warmer tones of the opening passage.

"A delicate primrose now appears, and with little

runs and flushes the pulsation leads through several passages of indescribable cinnamon colour to deep topaz. Then suddenly interweavings of strange green and peacock blue, with now and then a touch of pure white, make us seem to feel the tremulousness of the Mediterranean on a breezy day, and as the colour deepens there are harmonies of violet and blue-green which recall its waves under a Tramontana sky. More and more powerful they grow, and the eye revels in the depth and magnificence of the colour as the executant strikes chord after chord amongst the bass notes of the instrument.

"Then suddenly the screen is again dark, and there is only a rhythmic and echoing beat of the dying colour from time to time upon it. At last this disappears also, and there is another silent pause, then one hesitating

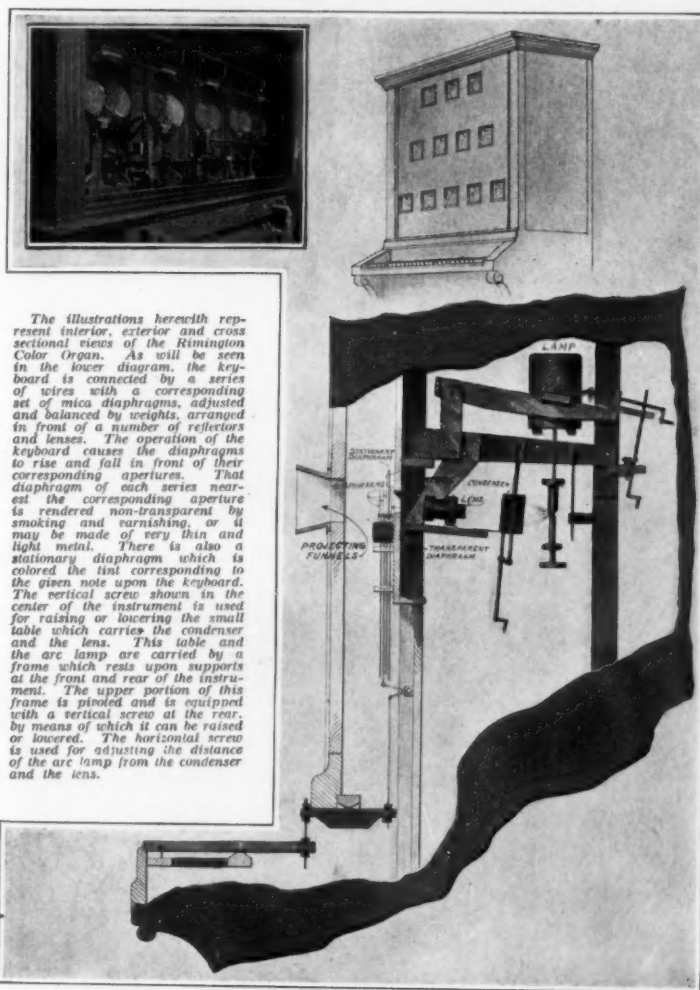
of light. Rimington employs naked arc lights, having a total candle power of about thirteen thousand. A well-known difficulty attending the construction of all arc lamps is to insure absolute steadiness of the arc. At one step in overcoming this difficulty, the Professor was led to invent a new form of carbon holder, which consists of a fireclay receptacle with three prongs, and has proved itself distinctly satisfactory. Nevertheless, a slight unsteadiness remains, and future experiments are going to be conducted with a metallic filament lamp. The mercury vapor lamp, in other respects very satisfactory, labors under the disadvantage that the red is almost entirely absent from its spectrum. The prisms are bi-sulphide of carbon prisms and the lenses are of the usual type. It is in the controlling mechanism that the resemblance to an ordinary sound

organ becomes prominent. We have a keyboard which is exactly similar to the keyboard of an ordinary organ. Depressing a key enables a current of compressed air to reach the valve of a small motor, which motor in turn draws down a diaphragm, thus permitting light of a color dependent upon the key struck to flood the screen. Instead of one diaphragm a number of diaphragms are used, thus enabling the intensity of the projected color to be regulated. A complete spectrum corresponds to each octave on the keyboard, and the striking of the two notes of an octave simultaneously, for instance, removes two diaphragms from the path of the light. The diaphragms are each carefully colored to the precise shade of that part of the spectrum that they normally intercept. By a further device the whole keyboard may be made to correspond to the range of the spectrum, but this is chiefly useful in improvising. An ingenious modification has been the introduction of an auxiliary diaphragm of mica, crossed by lines which crowd closer together as they approach one side. The light is therefore split up more at one side of the diaphragm than the other, and as the diaphragm is gradually removed from the light path, the light gradually grows in intensity. This prevents the light flooding the screen with disagreeable abruptness. The whole mechanism is really remarkably simple from the engineering point of view, although effects of considerable complexity can be produced by it. The compressed air is supplied by a bellows as in an ordinary organ.

Prof. Rimington is of the opinion that it is in combination with music that the new art will find its chief development. The close association of colors with sounds has always been noticed by musicians. In some works on music the writer has gone so far as to give a list of colors corresponding to the timbre of the various instruments in an orchestra. To most

people there is a distinct connection, which only requires to be pointed out. Thus Lavignae in his book "Music and Musicians," likens the timbre of an oboe to a rustic green, and the blast of a trombone to a heavy crimson. But this correspondence must not be made to assume an undue importance. While most people are agreed that certain instruments recall certain colors more vividly than others, there is no great unanimity of opinion respecting the colors chosen as belonging to certain instruments. But in its main lines the analogy holds good. Everyone would admit that a gradual fading from a bright to a dull color corresponds to a pathetic phrase in a musical composition. And vivid, striking colors do seem to correspond to the more vivid striking instruments of an orchestra. On this basis Prof. Rimington has devised color compositions illustrative of musical compositions, and the performance of the two together has been attended by the most satisfactory results. In writing a color composition musical terminology is employed, with the usual time markings and marks of expression. It appears that while most people find pleasure in a color composition done in slow time, rapid color passages require an educated eye. After a certain amount of training, however, rapid color passages are capable of furnishing a

(Continued on page 176.)



Apparatus with which the "music" of color is produced.

tint of faded rose as at the opening of the composition.

"Upon this follows a stronger return of the colour, and as the screen once more begins to glow with note after note of red and scarlet, we are prepared for the rapid crescendo which finally leads up to a series of staccato and forte chords of pure crimson which almost startle us with the force of their colour before they die away into blackness."

This description may serve to show the imaginative reader that the new art is capable of producing considerable emotional effect. The possibility of the new art had occurred to several people before Prof. Rimington undertook his experiments, but it is a far cry from mere possibility to the actual perfecting of an instrument which should turn the possibility to an actuality. The apparatus which has transformed the art of color music from a dream to a reality is called by Prof. Rimington a "Color Organ," and consists essentially of three parts.

We have firstly, the source of light; secondly, the prisms and lenses for splitting the light into a spectrum; and thirdly, the mechanism which enables the performer to project given colors on the screen for a given time. One of the chief difficulties attending the construction of the instrument was found in securing efficient sources

### A Million Shot Group

PROBABLY the first million shot group that has ever had its picture taken is shown herewith.

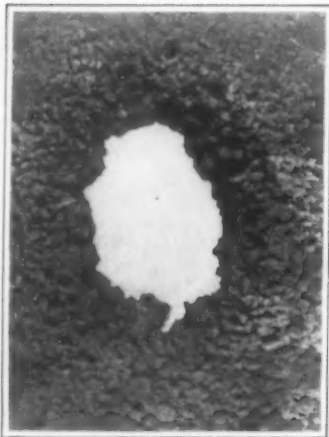
Speaking generally, most of us are content to regard a group of 10 hits, or may be two or three groups of 10 hits, as affording sufficient testimony of the accuracy or otherwise of a cartridge; it is something out of the ordinary therefore to get a single group of so many thousands of shots that if we call it a million we shall not be straining the truth overmuch.

The illustration depicts such a group made with the 0.22 rim fire long rifle cartridge used in a target rifle at 100 yards.

In the daily routine tests at a well known cartridge works in Bridgeport, a quantity of the cartridges are taken promiscuously from each loading machine every hour and mixed. Ten groups of 10 hits are then made from the machine rest at 100 yards, and these groups must conform to the required standard of accuracy or the batch is condemned. The ten targets are mounted in a revolving frame which turns one tenth of a revolution for each shot and brings each target alternately in front of the gun and opposite precisely the same spot on the stop butt behind, consequently the group made on the stop butt is a composite of all the groups on all the targets.

Our illustration is from a photograph (five eighths actual size) of the piece of the stop butt behind the targets, which, though of  $\frac{1}{2}$ -inch steel, is completely perforated and had recently to be replaced.

How closely the accuracy standard is maintained is clearly shown. The central hole, which obviously includes the majority of the hits, measures 2 inches by 1.4 inches—practically within the circumference of a silver dollar—while the thickly dented halo round it which embraces the remainder of the hits is just about 3 inches in diameter. The tendency of the group toward an oblong shape clearly indicates the normal grouping.



A hole that bears witness to accuracy in cartridges.



Motorcycle headlight and electric generator.



Curious "mackerel sky" formation that resembles a field of broken ice.

### Curious Cloud Formation

WERE it not for the clew of the trees silhouetted against the sky, one would be apt to turn the accompanying picture upside down and regard it as a field of broken ice instead of an excellent example of *Cirro-cumulus* clouds or what is commonly known as "mackerel sky."

We are indebted to Mr. Frederick M. Smith, of La Mesa, California, for the photograph. He writes:

"On the 17th of September a cloud formation passed over this place which was of such peculiar appearance that it tempted me to make a record of it. The field of clouds spread over an area of perhaps two and one half miles square. I have seen at different times this same formation, but not so strikingly displayed as it was on this occasion."

For the purpose of comparison we publish under the cloud picture a photograph of a field of ice. The picture was taken in Toronto Bay. If strong sunlight were reflected from the ice, the resemblance would be much more striking.



A field of ice in Toronto Bay. Compare with the picture above.

### The Motor-car Express

A NOVEL form of passenger service is to be found in California. A narrow gage railroad runs from Caldor to Diamond Springs, and to provide quick transportation over this line an automobile has been pressed into service. The wheels have been removed and car wheels substituted. The rear wheels are chain driven. The forward part of the vehicle is mounted on a four-wheel swivel truck. Of course the engineer or chauffeur does not attempt to steer the vehicle. The automobile is a 1907 model, but apparently it is still in good running condition. It is scheduled to make the round trip between Caldor and Diamond Springs (70 miles) in two hours and a half.



Motor car passenger service on a narrow gage railroad.

### Motorcycle Electric Lighting Outfit

THE elimination of oil and acetylene gas lamps from motorcycles grows apace; manufacturers slowly but surely are turning to electricity as an illuminant, a fact which is amply reflected by the new machines that are being placed on the market against the new season. Among the various dynamo lighting systems which have appeared within a comparatively short time, the one which is illustrated herewith has a number of individual characteristics which make it interesting and which should make it appeal to those who incline to side-step all complicated mechanisms.

As the picture shows, the outfit consists of nothing more than a tiny little dynamo which is clamped to the front fork of the machine and driven by frictional contact with the tire, and a reflector containing an incandescent bulb.

The construction of the dynamo is unusual. The field consists of a large bell-shaped magnet of the permanent type to which the aluminium casing is attached. The armature shaft is carried in ball bearings, both of which are between the armature and the driving wheel. The armature winding consists of a sufficient number of turns of fine wire to insure the generation of six volts when the speed of the motorcycle becomes about 25 miles an hour. As there is no commutator, it is evident that the current is alternating and hence that a storage battery cannot be used with the generator. To provide a source of energy for the lamp when the motorcycle is not running a few cells of dry battery may be used.

In the electrical connections, one end of the armature winding is simply grounded to the armature shaft. The other end is connected to a wire gauze brush which bears against a button on the end of the armature shaft. But one wire is needed between the generator and the lamp, the ground connection serving for the return. The weight of the generator is only two pounds.

### A Quick-acting Thermo-pile

ORDINARY thermo-piles are rather slow-acting instruments. In their original form, as suggested by Melloni, they are made up of a number of metal rods joined in a batch, at the outer ends of which there are the two rows of soldered joints. On account of the great heat capacity of such a system, any increase in the temperature of the joints exposed to heat radiation is bound to last a long time, temperature equilibrium being reached very slowly.

In a paper recently read before the Amsterdam Academy of Sciences, J. H. Moll describes a new type of thermo-pile made up of a large number of small metal strips consisting partly of constantan and partly of copper, and which at their two outer ends are soldered to two copper terminals. The constantan-copper strips may be in their entirety exposed to the radiation, when on account of the very considerable difference in heat capacity of the two joints, the central joint is raised to a higher temperature than the outer one. However, mainly by reason of the excellent heat conduction between the two joints, these, after a very short time, will reach temperature equilibrium. Since the two metals have very different coefficients of heat conduction, their thickness and length should be chosen at such a ratio that during heat radiation the temperature in the central joint is highest.

Such elements are most readily combined into thermo-piles. One of those constructed by Moll comprises 80 elements which, arranged in 3 rows, filled up nearly completely a circle 2 centimeters in diameter and possess a total resistance of about 9 ohms. The sensitiveness and absence of inertia are strikingly shown by the fact that the light from a standard candle, at 1 millimeter's distance, will set up in it a thermo-force of 18 microvolts, the thermo-current reaching within  $1\frac{1}{2}$  seconds, 99 per cent of its definite figure.



## A Multiple-brush Boring Machine

By H. M. Baxter

A GREAT step forward in brush manufacturing was the introduction of multiple boring machines. These machines, shown in operation in the accompanying illustration, will bore all the necessary holes in any straight bored brush-block. In addition to the great saving in time, this method reduces the breakage of blocks to a minimum, thereby still further lessening the cost of manufacture.

The machine on the right is turning out a triangular wooden block, for a special ball-bearing revolving scrub-brush. The one on the left is boring leather blocks for horse brushes.

Practically all such machinery works on a ratchet principle—each size and style of brush necessitating a special die or mold containing the requisite number of bits, properly arranged. The various bits are very long and made of tool steel, each end being held in place by a plate or form containing the correct quantity and sizes of holes. A third plate, containing the same arrangement of holes, grasps each bit in the center, where a ratchet, or offset, of several inches, permits the machinery to move this third plate, thereby causing each bit to revolve with the required speed.

In order to make these bits work smoothly together, they must obviously all be perfectly straight at the ends as otherwise they would clash when revolving.

As a result of this principle the machines are unable to bore any except perfectly straight holes, and where the brush material must be set at a slant, the machines are useless and such boring must still be done one hole at a time.

The inventor who produces a machine that can multiple bore a brush-block—the center holes being straight and the succeeding ones to be slanted at varying angles, will be able to command his own price for the device. And a machine that can be adapted or adjusted to bore various sizes and styles of brushes would be a great money saver, as the individual brush dies or molds are costly to manufacture, ranging in price from fifty to a hundred and fifty dollars each, according to size, etc.

## A Pocket Edition Motor Vehicle

SURELY the motor vehicle has been shaved down to its lowest limits of size in the power-driven skate herewith illustrated. A similar skate, but electrically driven, was described in the SCIENTIFIC AMERICAN of Dec. 13th, 1913. But while this was more compact than the gasoline-motored skate, it was not completely self-controlled, for it obtained its power from a storage battery carried on the back of the skater. Both of these skates are the invention of Mr. Bruce S. Eyttinge, who has shown considerable ingenuity, particularly in the construction of the skate here illustrated. A three-wheel roller skate is employed with five-inch wheels and a wheel base of twenty-five inches. The front pair of wheels does the driving and is belt connected to a twin-cylinder gasoline engine. The base and two crank cases are formed in a single aluminum casting. The driving is done direct from between the opposed cylinders to a pinion between the two front wheels, thus giving a perfect balance. A three-pound flanged flywheel is carried between the cylinders as best shown in the small inserted engraving. The crankshaft has only two bearings which are located in the adjacent wall of the crank casing. By eliminating the bearings in the outer walls of the casing, the weight is reduced. The motor is of the two-cycle type with 1¾-inch bore and 2-inch stroke, and it develops one horse-power at about 1,800 to 2,000 revolutions. A steering post extends upward from the engine and, owing to the dual front wheels, steering is effected by leaning the post to one side or the other. Attached to the steering post is a gasoline tank and a miniature spark plug, while within the steering post, which is hollow, lubricating oil is carried and fed by gravity to the parts that require it. A battery of four dry cells is carried on the back of the skater, and there is a switch on his belt. The entire weight of the outfit is 30 pounds. With it Mr.

Eyttinge has traveled at speeds of over twenty miles per hour on the streets of New York, and he believes that twenty-five to thirty miles per hour may easily be attained. No brake is supplied, but merely cutting off the spark serves to retard the skate, owing to the compression in the engine cylinders. By this means the skates can be brought to a stop from a speed of twenty



A multiple brush-boring machine.

miles an hour in about seventy-five feet, without using the idle skate as a drag. However, it is much more convenient to make a turn in case an object is suddenly encountered. Very sharp turns can be made because the skater can lean inward as far as he likes to overcome centrifugal force.

## A Cancer Indicator

AN entirely new mode of attack upon such obscure problems as that of cancer has recently been opened up by experiments which Prof. L. L. Woodruff and F. P. Underhill of Yale University have conducted upon the growth of Protozoa in fluid extracts from normal

and diseased tissues. Hitherto, experiments to study the effect of diseases upon living matter have been chiefly by means of injecting fluid extracts of the diseased organs into such animals as rabbits, dogs, etc., and then to study what physiological changes take place throughout the system. While this method is of the utmost value and has tremendously increased medi-

cal knowledge concerning the ravages of some of our most dreaded diseases, yet there are many points which still defy the student of these problems. Among such highly organized animals as dogs or cats it is impossible for any two individuals to be precisely similar in their constitution, and in consequence no two individuals will react wholly alike under experimental conditions. One individual may possess an immunity to a given disease or only be slightly affected by it, while another will, because of its particular constitution, be very seriously affected. Furthermore, it is not always possible to detect that the diseased organ is undergoing any chemical change, although the effect is only too evident.

The investigators conceived the idea of taking a single cell of living protoplasm, namely Paramecium, and raising individuals from this one by allowing it to divide many times under the same environmental conditions. Thus they obtained a large number of single-celled animals whose composition was the same and whose manner of reacting to any fluid in which they were placed would obviously be the same for that particular fluid. Furthermore, because of the unicellular nature of the animal all parts of the body would react alike to the fluid in which it was placed, thus rendering it a very sensitive chemical reagent, so to speak.

Their method of obtaining results was to study the rate of division of paramecium in different fluid extracts. Under normal conditions, paramecium will grow and divide regularly, while it is sensitive to any abnormal condition to which it is subjected, and will show this by a change in the rate of division and even death. The growing condition of paramecium in extracts from normal and diseased (nephritic) kidneys of rabbits was first tested, by numerous experiments, to see if paramecium could be used as a "biological indicator of chemical change." This proved to be the case since the division rate of paramecium was much depressed in extracts from the diseased organs. The work was then extended to cancerous material. It was found that the rate of division of paramecium is much retarded in extracts from carcinomatous material of the human breast when compared with the rate of those grown in extracts from normal portions of the same breast. This shows what research has hitherto been unable to demonstrate positively, namely, that in tissues affected with this disease there are chemical changes taking place which are injurious to living protoplasm. It may indicate either the decrease or complete absence in carcinomatous tissue of certain substances necessary for vitality, or, on the other hand, it may indicate the presence of injurious substances.

## How to Fix Screws in Place

WOOD screws used for small hinge often become loosened in the hole so that it becomes difficult to fix the hinge when this occurs, and on the other hand in the case of wood boxes or the like it is not always possible to use a larger sized screw in place of the small one when the hole works large. Screws can be fixed once for all by making a small notch in the metal at the edge of the hole, then screwing down the screw as usual and putting in a small pin through the edge of the screw slot and the small notch at the same time, this keeping the screw from turning.

**A Parcel Post Egg Carton.**—A carton in which a case is provided with relatively inclined walls between which the end of an egg may rest and a separate section having similar walls arranged transversely to the first walls and adapted to engage the opposite ends of the eggs is described in a patent No. 1,083,694 to James L. Myles of Hadden Heights, N. J., and William L. Gedders of Overbrook, Pa.



Automobile skate that makes twenty to thirty miles per hour.

## RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

## Pertaining to Apparel.

**BLOUSE.**—M. HANDELSMAN, care of Klingert & Bach, 737 Broadway, New York, N. Y. An object here is to provide a structure arranged on the waist line of the blouse for permitting any desired adjustment. Another is to provide a plurality of adjusting straps arranged on the waist line of the blouse at a point spaced from the front so that the front may be buttoned from top to bottom without interfering with the adjustment.

**UNBUTTONING IMPLEMENT.**—C. E. COLLINS, Manhattan, New York, N. Y. This inventor's aim is to provide an implement for quickly unbuttoning buttoned shoes without danger of unduly straining the buttons or injuring the buttonholes and without requiring much physical exertion or skill on the part of the user or operator.

**SHOE EXPANDER.**—C. D. COMPTON, 404 Bleeker St., New York, N. Y. This invention relates to a novel device, including expanding members, to fit within the shoe, and movable toward and from each other, there being a wedge and means for advancing the wedge for forcing the expanding members apart against the opposite sides of the shoe.

**PORTABLE WARDROBE.**—A. E. KINEN, 8 Avenue Marceau, Paris, France. This invention refers to a portable wardrobe which is formed of a box the cover of which is provided with hooks or other devices for the suspension of garments and is adapted to be supported above the box by rods or uprights which can be folded together and are contained within the said box.

## Electrical Devices.

**ELECTRICALLY OPERATED AIR BRAKE.**—H. L. TOOKER, Grand Canyon, Ariz. This invention provides an electrical control, analogous to the triple valve commonly used for handling the pneumatic elements of the brake mechanism. The engine by manipulating a hand lever, can operate the electro-pneumatic control independently of the usual air-controlled mechanism.

**ELECTRIC FURNACE.**—GIACOMA METZLER, Berlin, Germany. This invention relates to an electric resistance furnace which can be continuously charged and uniformly regulated up to temperatures of about 2,400 deg. Cent. (4,352 deg. Fahr.). All the parts of the furnace are easily accessible and exchangeable, and the contraction or warping of the parts cannot unfavorably influence the operation of the furnace.

## Of Interest to Farmers.

**CHECK ROW PLANTER.**—L. J. HELGESON, Fisher, Minn. This invention comprehends a type of check row planter provided with marking attachments located upon its opposite sides, and each adapted to be thrown into or out of action independently of the other, at the will of the operator.

**RECEPTACLE AND CARRIER FOR EGGS.**—R. M. ODELL, P. O. Box 211, Plainfield, Indiana. An object here is to provide a receptacle for eggs which are shipped in the ordinary egg case, and which will prevent the breakage of the egg, and which will also provide an air-tight and light-proof chamber for each egg, thereby tending to prevent their decomposition.

**AUTOMATIC STOCK FEEDER.**—S. MENDEL, 359 1/2 5th Ave., Brooklyn, N. Y. The invention relates to improvements in stock feeding machines, and particularly to an automatically actuated feeding device which may be set to operate at any desired time. The device is constructed as an entirety or single entity so that it may be applied at any point in any stable or other place without changes being made.

## Of General Interest.

**FURNACE FOR REFINING METALS.**—E. C. WILLS, 116 E. Church St., Frederick, Md. An object here is to provide a device which may be rocked or oscillated so as to cause a movement of the liquid metal, so as to bring the latter in the most advantageous position for air treatment, and also causing the dross to be more easily eliminated.

**LINK BRAKE BELT.**—J. DUPUIS, 557 Brayton Ave., Fall River, Mass. The object of this improvement is the provision of a belt comprised of inter-engaging links, each link carrying a block of fibrous material, having a high coefficient of friction, wherein a special form of holder is provided for supporting the block.

**DIVING APPARATUS FOR SUBMARINE WORK.**—M. BEMBRINA and L. DURAND, Palermo, Italy. The invention refers to a diving apparatus for submarine work formed by a hull mounted upon four wheels, which works like a small submarine boat designed to perform submarine explorations as well as submarine searches and work, and which may be called a micro-submarine boat.

**FIRE EXTINGUISHER.**—P. B. BARRINGER, Charlottesville, Va. The principal object here is to provide a fire extinguisher of simplified

construction, adapted to contain a number of solutions or substances for fire extinguishing purposes, the said substances or solutions being maintained separately solely by the differences in the specific gravity thereof.

**TELESCOPIC SIGHT.**—W. V. HURILL, Bethany, W. Va. This invention has reference to Galilean telescopes and its object is to provide a new and improved sight for such telescopes to permit the use of the Galilean telescope on surveying instruments, rifles and other devices for sighting purposes.

**INDEXED BOOK.**—R. H. TYLER, 86 Wadsworth Ave., Manhattan, N. Y., N. Y. This invention provides a book indexed by employing syllabic or phonetic keys or guides; employs conjunctively with the said keys groups of letters having the vowel sounds; and employs designating marginal indices to be used in conjunction with each of the keys.

**NON-REFILLABLE BOTTLE.**—P. E. WARREN, New York, N. Y. This invention provides closure devices that will permit the liquid contents of the bottle to be decanted, if desired, but which will make the refilling either impossible, or so difficult as to make the refilling unprofitable.

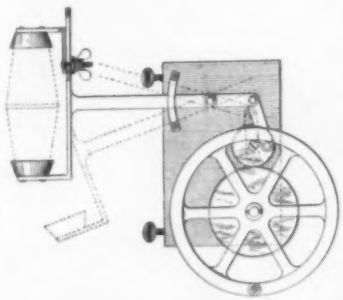
**PRINTING FRAME.**—W. G. CLEMENTS, 61 Dunmoreland Ave., Springfield, Mass. This inventor provides a printing frame in which the negative and print may be placed in position and held firmly in position while closing the hinged cover. He also provides a device which will print from negatives of different sizes.

**SANITARY SUGAR HOLDER AND DISPENSER.**—A. G. BETTMAN, 511 Eller Bldg., 7th and Adler St., Portland, Ore. This invention has for its design the provision of a holding and dispensing device especially useful for dispensing sugar, and arranged for automatically discharging a measured quantity of sugar as desired. It provides means for readily adjusting the device to vary the measured quantity that will be discharged.

**VAULT LIGHT.**—A. DE MATEO, JR., 107 Varick St., N. Y., N. Y. This improvement provides a plurality of frame members having openings in which lights are secured, these members being disposed on mold members having upwardly extending flanges, which are disposed around openings therein, and under the frame members, so that cement may be disposed on the mold members and between the frame members, and the mold members may be removed after the cement has set.

**PROCESS OF EXTRACTING PRODUCTS FROM WOOD.**—W. B. HARPER, Bay Minette, Ala. Mr. Harper extracts turpentine and other light terpenes by means of live steam under low pressure and temperature followed by superheated steam under any desired pressure and at a temperature sufficient to remove the pine oils from the wood, and, subsequently, treat the remaining resinous material with a suitable solvent, the resin and solvent being afterward separated to obtain the pure resin.

**SHAKER.**—L. V. LOPEZ S., Circulo Naval, Valparaiso, Chile. The object of this invention is to provide a device for mixing beverages and other liquids, and in which the liquid contain-



SHAKER FOR LIQUIDS.

ers will be disposed horizontally and reciprocated in the horizontal plane instead of in vertical plane. He provides a shaker having a construction designed to promote convenience in the use of the shaker, and effect a rapid and thorough shaking of the liquid.

**LIQUID PISTOL.**—R. PARKER, 300 Sheffield Ave., Brooklyn, N. Y. The general object here is to improve and simplify the construction and operation of a device so as to be reliable and efficient in use, composed of comparatively few parts and so designed that the bulb is effectively protected against accidental compression, although it is conveniently accessible for intentional compression by the user.

**FLUSHING APPARATUS FOR SUBMERGED WATER PIPES.**—L. E. SMITH, care of A. B. Smith, Newton St., N. W., Washington, D. C. This apparatus is for use in a system of water filtration and supply for towns and cities. The water intake pipes which are provided with small slots are laid in a natural sand and gravel bed in the bottom of a river or lake, and other pipes connected therewith are extended to a pump-house located on the bank at a greater or less distance from the source of supply. It is expedient and even necessary to flush the intake pipes occasionally in order to remove foreign matter which may have accumulated in the inlets proper or on

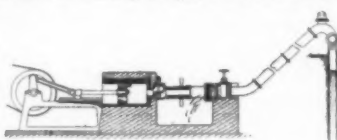
the sand and gravel bed on which the pipes are laid.

**CARBONATOR.**—D. ERIT, Westport, N. Y. This apparatus carbonates and dispenses beverages, and the device produces a rapid and perfect saturation of the liquid with carbon-dioxid. The carbon-dioxid and water are forced to pass together through a continuous passage provided with a plurality of perforated and whirl-forming diaphragms toward the dispensing nozzle.

**LETTER.**—W. S. BOCK, 81 Lake St., Corona, L. I., N. Y. This invention relates to improvements in signs, and particularly to signs or letters having translucent portions, and has for an object the provision of an improved structure which is adapted to be clearly seen either day or night.

**BUILDING CONSTRUCTION.**—A. B. COON, Little Rock, Ark., and A. VAN DE SANDT, Tacoma, Wash. Address Dr. A. B. Coon, 20 Urquhart Building, Little Rock, Ark. This invention is an improvement in building construction, and the object is to provide an anchor and tie especially adapted for use in connecting an ornamental facing, as for instance, of marble, glass, tile or the like, to a wall, to hold the said facing in the proper relative position with respect to the said wall.

**SIPHON AND STARTING DEVICE THEREFOR.**—W. F. STUART, Garden City, Kan. The object of this invention is to provide a simple means for starting a siphon which is used for



SIPHON AND STARTING DEVICE.

irrigation or handling water for any purpose where conditions are right automatically so that the water may flow continuously without further application of power. Simple means is supplied for checking the flow of the siphon at will, and a device is provided for starting the flow which may be removed from or applied to the end of the siphon.

**ANTI-SLIPPING ATTACHMENT FOR HORSESHOES.**—H. B. PAINE, Patchogue, N. Y. The invention provides an attachment for one side of a horseshoe, the same being adapted to be removably clamped thereto by an easily manipulated means, the device to be equipped with any suitable form of calks depending upon the nature of the weather or conditions of ground to be traveled. Two of these devices will be employed upon each horseshoe.

## Hardware and Tools.

**CURRYCOMB.**—J. B. PROUTY and AMOS H. MATTHEW, care of the latter, Colville, Wash. This comb comprises a blade produced from sheet metal and having disposed at different edge portions thereof teeth of different characters, as well as a scraping edge, whereby to perform scraping, currying, and combing, together with a handle so disposed on the blade as to promote convenience in the turning of the device to present a particular edge portion of the blade in proper position for use.

**TRY, RAFTER AND MITER SQUARE.**—G. E. STANWOOD and W. E. SMITH, Box 51, Middletown, N. Y. Among the objects of this invention is to improve these devices whereby they are made more simple in construction and principle of operation, and hence, whereby they are more durable and reliable in use both as to physical construction and effectiveness in carrying out the scientific principles involved.

**THREAD CUTTER.**—J. A. DOWD, P. O. Box 411, Fall River, Mass. This invention provides a cutter which may be driven at various speeds without affecting the quality of thread produced so a maximum speed may be maintained without injury to the threads being cut. It provides a cutter having a flat face which may be ground off whenever the cutting teeth are rounded or dulled in order to present a new or sharp engaging portion.

**DRESSER FOR BOILER CAP SEATS.**—S. DIESETH, Carteret, N. J. The invention provides in a tool of this character means for the ready interchange of cutting and scraping members; and provides a head adapted for alternate combination with a power driven mechanism or a hand tool.

**NUT LOCK.**—A. H. WEGENER, 1105 Garden St., Hoboken, N. J. In the present patent the improvement refers to nut locks of that type in which there is a rotary member constituting under certain conditions a wedge preventing by its co-operation between the bolt and tapering portion of the nut a movement of the nut in a certain direction.

**LOCK.**—J. C. SULLIVAN, 647 Lexington Ave., N. Y., N. Y. This lock is more especially designed for use on handbags, valises, suitcases, etc., and arranged to securely hold the article locked to enable the owner to readily open the article, and to prevent pickpockets and other unauthorized persons from surreptitiously opening the article.

**ROOFING IMPLEMENT.**—J. N. FARNHAM, 32 Cedar St., Rockland, Maine. This tool provides a means whereby the application of all kinds of felt or roll roofing may begin at the top of the roof. The tool holds the lower edge of each successive sheet out of the way

while the next lower sheet is being placed and the cement applied and provides a means whereby both contacting edges can be covered with cement. The tool forms a guide to lay each successive sheet and allows for the proper lap. It lessens labor and damage to material and insures a neater job, as all work is done below and off the finished portion.

**WRENCH.**—W. L. BESSOLO, McAlester, Okla. The invention provides a wrench having two jaw members pivoted together, one of the jaws being pivoted to the handle, the other jaw being connected to the handle by a link. As the wrench is constructed it is possible for a mechanic to make use of it with one hand.

## Heating and Lighting.

**TRAFFIC LANTERN.**—S. F. DU REE, Longbeach, Cal. The present invention has reference to traffic lanterns, and more particularly to a lamp box adapted to contain a light provided with transparent portions whereby to eliminate all danger in traffic by an obstruction in darkness.

**BAKER'S OVEN.**—F. C. IHLEE, Westwood Works, Peterborough, England. This invention relates to bakers' ovens, in which the heating elements comprise closed tubes containing water or other fluid known as "Perkins tubes," "circulating tubes" and "loop tubes," and arranged to project at one end into the furnace to be acted upon by the heat generated in the latter.

**HEAT TREATMENT OF METAL BODIES.**—J. H. BARKER, Birmingham, England. This invention relates more especially to the annealing of metal cartridge cases at the ends in which the bullets are secured. The annealing is effected by heating electrically only unloaded portions of the cases, and at such a rate that the operation occupies insufficient time for the other portions of the cases to attain a temperature liable to ignite the charge, or at such a rate that such portions can readily be maintained at a safe temperature by an air current or other equivalent means.

**HOT WATER DEFLECTOR.**—N. MCC. DAVIDSON, Hanover, Pa. The device has a screw-thread by which it may be connected with either one of the three screw-threaded openings of a standard T-fitting of the kind numerously used in the pipes of a hot-water system for heating, where one pipe branches from another, and where it is desirable to have means that will equalize the circulation of hot water in both pipes.

**POCKET FIRE OR LIGHTING APPLIANCE WITH PYROPHORIC METAL.**—FRITZ HOFMANN, Munich, Germany, care of M. E. Bernhardt, 157 Chambers St., New York, N. Y. This invention relates more particularly to such a form and arrangement of the constituents necessary for producing a spark, that these parts may be themselves put together without soldering and in this assembled form inserted in a case. It provides an improved formation of the coupling between the operating tooth wheel and the friction wheel, and the device insures at all times the fixed relative relation of the pyrophoric metal and the friction wheel, and thus insures a proper contact of this metal with the friction surface of the friction wheel, and prevents accidental disarrangement of these parts in use.

## Household Utilities.

**TOWEL HOLDER.**—D. R. MICHIE, 8660 Vincennes Road, Chicago, Ill. This device relates generally to devices for use in holding towels and more particularly it involves an article of simple construction and pleasing appearance which will effectually perform the function for which it was designed.

## Machines and Mechanical Devices.

**SUGAR DISTRIBUTING BOWL.**—S. A. ADAMS, 944 Tiffany St., Bronx, N. Y. The purpose in view is to provide a bowl designed to dispense or feed one piece of sugar at a time therefrom, the feeding means being adapted to be operated at any desired speed so as to feed the sugar from the bowl at a rapid rate or comparatively slow.

**GAS ENGINE VALVE.**—R. E. DRENNON, Address Hendrix & Silverman, Suite 910, Hunt Bldg., Atlanta, Ga. This inventor provides a device wherein a single rotating valve with a large bearing surface is utilized for controlling both the inlet and the exhaust, operated directly from the crank shaft, and so arranged that when the valve is removed access is permitted to every part of the cylinder.

**CUSHIONING DEVICE.**—E. SCHUCH, 25 Giselastrasse, Munich, Bavaria, Germany. The invention provides a cushioning device arranged to cushion the plunger in the pressure cylinder on the sudden application of the initial pressure, so that the indicator mechanism is not subjected to sudden dangerous shocks or jars.

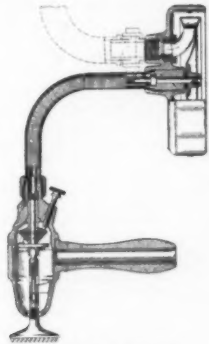
**STARTER FOR TALKING MACHINES.**—H. B. FITZGERALD, 134 Midland Ave., Glenridge, N. J. The invention relates to starters for talking machines, and has for an object to provide an improved structure which will instantly start the record moving at any time automatically so that when the device is once set, no further attention need be paid the same.

**SLIP JOINT MACHINE.**—J. P. HARNER, 827 Main St., Nevada, Mo. Mr. HARNER'S invention relates to a machine for producing on an edge of a sheet of metal, slip joint members



and more particularly the design is for the production of a machine especially adapted for the formation of slip joint members on cave troughs.

**MASSAGE VIBRATOR.**—G. S. TUNE, 57 Bay 26th St., Brooklyn, N. Y. This invention relates to a massage vibrator of that type in which the oscillatory element is driven from a motor through a flexible shaft, the motor being of the water turbine type. It provides an effective connection between the oscillatory element and rotary shaft of the device, which connection is adjustable to obtain a light or



MASSAGE VIBRATOR.

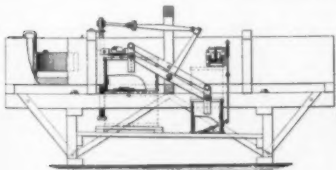
heavy vibratory action. By the provision of an improved mounting a rapid movement of the vibrator is insured. A form of motor of high efficiency is provided propelled by water taken from an ordinary city service pipe.

**STARTING AND STOPPING DEVICE FOR PHONOGRAPHS.**—F. E. HARE, 612 W. King St., Martinsburg, W. Va. The purpose here is to provide a starting and stopping device for phonographs and such machines and arranged to enable the user of the machine to readily start the same and to permit of conveniently and quickly setting the device according to the record with a view to automatically stop the machine at the time the stylus reaches the end of the groove in the record.

**GROOVING MACHINE.**—J. J. MARSTALL, care of Marstell Furniture Co., Henderson, Ky. This improvement has reference to wood-working machines, and its object is to provide a new and improved machine more especially designed for simultaneously forming pairs of diverging grooves in two boards or other pieces of stock.

**AUTOMATIC VENDING AND CHANGE MAKING MACHINE.**—E. E. HENRY, 214 9th St., Astoria, Ore. This machine delivers merchandise, but is more particularly designed for a ticket-vending and money-changing machine in which coins of different denominations may be inserted, and change delivered to the value of the inserted coin, or in which coins or equivalent checks of varying value may be inserted and tickets and change be delivered to the value of the said coin or other check.

**AUTOMATIC SPILLWAY.**—C. SCHALLER, Cortez, Colo. The invention relates to artificial water courses, such as flumes, irrigation ditches or the like. Among the objects of the invention is to provide a ditch having an



AUTOMATIC SPILLWAY.

automatically operated gate which, when the depth of water becomes too great in the ditch will operate to relieve such overflow and hence prevent any objectionable circumstance which might be incident to such undesirable rise of water in the ditch.

**POST COLLAR FOR ROCK DRILLS.**—R. NETTELL, care of J. F. Hamblitz, Houghton, Mich. This invention relates to the collars sometimes termed safety clamps, used on drill columns or posts below the drill, or below the column arm if the latter be employed. The object is to produce a collar which may be quickly and effectively adjusted in position and instantly loosened when required.

**CONCRETE MIXING MACHINE.**—E. L. CHIDGE, care of Speed Mach. Co., 70 Erie St., Passaic, N. J. The object here is to provide a machine of the revolving type which may be used as a "continuous type" so-called, for mixing the concrete in predetermined quantities, or in a continuous stream, as may be desired.

**WASHING MACHINE.**—P. WERNER, care of E. SPINDLER, 325 W. 29th St., New York, N. Y. The invention provides a supporting frame for a machine, readily adjustable to tubes of various makes and shapes; provides a swinging frame which may be readily lifted out of the way when placing in or removing from the tub, the clothes to be washed.

**PRINTING MACHINE.**—J. DEC. HALL, 4th U. S. Infantry, 328 B. Meade Ave., Fort Leavenworth, Kan. The principal object here is the provision of a machine adapted for the

mechanical cancelling or indorsing of checks in banks or other institutions where the large amount of such work necessary entails considerable time when done by hand.

**GEOGRAPHIC POSITION INDICATOR.**—F. R. SWEENEY, 2183 12th St., Troy, N. Y. This improvement provides for automatically and at all times indicating the position in degrees of latitude and longitude of a moving body; provides a plurality of members, one thereof being maintained parallel to the earth's polar axis and the other of said members being maintained fixed in space without reference to the earth's surface; and provides the members mentioned with indices adapted to show the variation of the plumb levels at all points on the earth's surface.

**MOTOR KNIFE GRINDER.**—A. P. REDDEN, 10 Clifton St., Worcester, Mass. This improvement has reference to machines for grinding wood-working tools, and has particular reference to a machine adapted to be operated especially by electric motor, and is therefore portable so as to be moved in any suitable position in a work-shop or mill.

**AIR PUMP LUBRICATOR.**—G. M. SCHWEND, Birmingham, Alabama. Mr. Schwend's invention is an improvement in air pump lubricators, and has for its object the provision of mechanism for use with air pumps, wherein means is provided for throwing a charge of oil and water into the cylinder of the pump operated by the action of the pump.

#### Prime Movers and Their Accessories.

**MULTIPLE POWER ENGINE.**—W. S. WEIKEL, Lillydale, Monroe Co., W. Va. In this case use is made of high pressure cylinders, connected pistons in each pair of cylinders, steam chests for each pair of cylinders and connected by sets of admission and exhaust ports with the ends of the corresponding cylinders, valves in the said steam chests and controlling the ports, the exhaust motive agent from one end of a high pressure cylinder passing partly into the other end of the same cylinder and partly into one of the low pressure cylinders, and the exhaust motive agent in one low pressure cylinder being used expansively in the other, the pistons in the low pressure cylinders reciprocating at double the speed of those in the high pressure cylinders.

**DAMPING TORSIONAL VIBRATIONS IN CRANK SHAFTS.**—F. W. LANCHESTER, 53 Hagley Road, Edgbaston, Birmingham, England. The invention relates to high-speed reciprocating engines, and more especially to an improved method of and apparatus for eliminating certain forms of vibration in the running of high speed multicylinder engines, such as the four and six-cylinder internal combustion engines used for the propulsion of motor vehicles.

**EXPLOSIVE ENGINE.**—D. M. TULLOCH, 130 Pearl St., New York, N. Y. This invention more particularly is directed to an engine having an improved means of control of intake and exhaust. The principal design is to provide a mechanism for controlling the intake and exhaust of cylinder gases, the said mechanism being positively actuated by the reciprocating piston.

**TEST OR PRIMING COCK.**—B. MORGAN, Tew's Court, Newport, R. I. The invention refers more particularly to a device which comprises a cylinder plug and a closing plug movably associated with the cylinder plug, the cylinder plug affording means for the introduction of an explosive fluid into the cylinder upon which the device is mounted, and having a valve-seat, the closing plug having a self-centering valve-seat-engaging part adapted to close the cylinder plug.

#### Railways and Their Accessories.

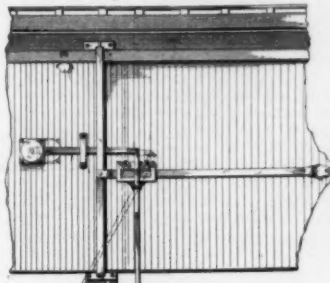
**ADJUSTABLE TIE-PLATE.**—J. ODIER, 49 Ashton Place, Buffalo, N. Y. In the present patent the invention has reference to tie-plates for railways, and the object thereof is the provision of a strong and inexpensive plate which will accommodate rails of different sizes and which will prevent lateral movement of the rails positioned thereon.

**RAILWAY SWITCH.**—J. W. HUBBARD, Eau Claire, Wis. The purpose here is to provide a construction of locking device for railway switches which will operate more readily and advantageously than the apparatus set forth in this inventor's application for a patent, Serial Number 660,257, and to this end he provides his improvements with suitable anti-frictional braces to engage the side of a draw bar and afford the desired results.

**SELF LOCKING SPIKE.**—G. I. DE FORCE and MONES DRYFOSS. Address the latter, 508 State St., Erie, Pa. This invention comprehends a spike having all the advantages of an ordinary spike, and at the same time provided with shoulders of peculiar form for preventing the ready withdrawal of the spike from the wooden cross tie or other analogous member into which the spike is driven.

**CAR COUPLING.**—AUGUSTA L. ROBERTS and BERTHA L. ROBERTS, 900 W. Front Ave., Ashland, Ky. This invention relates to railway draft appliances and has particular reference to car couplers of the Janney type. The improvement provides for a number of structural features of advantage of the detachable yoke member constituting the main part of the device, whereby the same is strengthened and otherwise made more reliable in practice.

**CAR DOOR OPENER.**—J. W. CARVER, Hay Springs, Neb. The invention relates to an apparatus adapted to be installed on grain or box cars for affording convenient means for opening and closing the slide door of such cars. The invention provides a stationary



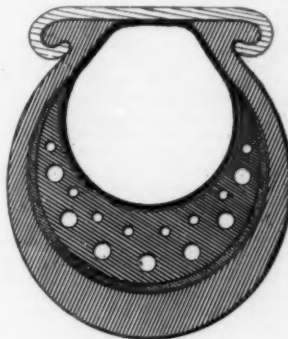
CAR DOOR OPENER.

frame applied to the body of the box car and including a track along which moves a carriage that is operatively connected with the doors, said carriage being moved step by step in one direction by a novel mechanism to open the door and in the opposite direction to close it.

**MACHINE FOR GROOVING RAILWAY SLEEPERS.**—A. PANKL, Kommanditgesellschaft Guido Rütgers, Vienna, Austria-Hungary. In machines for cutting into the upper surface of the sleeper receiving the tie plate, the ends of the sleeper are yieldingly pressed against fixed guide rails near the rotary cutters and then pushed past the latter, whereby such grooves of desired width are cut in the predetermined position and whatever may be the thickness of the blank or its transverse sectional shape. But if the upper surface of the raw sleeper is not plane for any reason, then the groove may become too deep or too shallow, the sleeper is either too much weakened by the groove or the groove is too shallow for the purpose. The inventor overcomes this difficulty.

#### Pertaining to Vehicles.

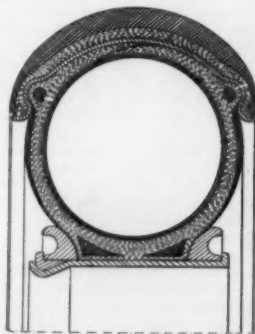
**SHOE.**—R. D. S. BENNETT, 514 West Mt. Vernon St., Springfield, Mo. This invention relates to tires and parts associated therewith, the more particular purpose being to provide



CUSHION SHOE.

an improved form of cushion shoe forming practically a part of the tire and adapted for maintaining the firmness thereof while permitting a considerable degree of resilience in the tire. It further relates to improvements in shoes or cushions forming parts of tires and carried thereby for the purpose of increasing the general efficiency of such structures.

**PNEUMATIC PUNCTURE PROOF TIRE.**—F. NEUBAUER, Valley City, N. D. In this patent the invention relates to pneumatic tires for use on automobiles, and includes a novel, detachable, puncture proof tread, as well as a tire extending continuously in closed form at the inner side, whereby the inner tube is effectively protected against possible damage by defective wheel rims. The accompanying engraving shows in cross section a tire embodying the invention.



PNEUMATIC PUNCTURE PROOF TIRE.

**AUTOMOBILE SLEIGH.**—W. J. WRIGHT and R. H. HOCKIN, Oak Lake, Manitoba, Canada. This attachment is for use in connection with automobiles and other motor vehicles

for the purpose of propelling such vehicles through the snow and it comprises an arrangement of parts upon which the body of an automobile or other motor vehicle can be easily and readily mounted when road conditions are such as to make the ordinary apparatus of the motor vehicles of little or no utility.

**VEHICLE STEERING DEVICE.**—F. S. HARRIS, Waverly, Ill. For the purpose of this invention, use is made of brackets attached to the axle and steering rod members pivoted on the brackets and having a sliding connection with each other, and a single spring engaged at its ends by the said members to compress the spring on shifting the steering rod sideways in either direction.

**SNOW PLOW.**—W. L. STADIG, Soldier Pond, Maine. An object here is to provide a machine so mounted on sleds as to accommodate itself to uneven roads; to provide for convenient adjustment of the snow removing devices to the end that a wider or narrower way may be cleared, and the snow removed to produce an essentially level way, or to leave a ridge or cone at the center.

**VEHICLE WHEEL.**—G. R. WILLIAMS, 620 Empire Bldg., Atlanta, Ga. The invention relates to resilient wheels, and provides a structure presenting advantages over what is described and claimed in Letters Patent No. 921,493 granted to Mr. Williams. The principal object of the present patent is to provide a wheel, characterized by an arrangement of parts in which the spokes of the wheel are in a condition of initial stress.

**VEHICLE FENDER.**—G. HIPWOOD and P. EGAN, 39 Cortland St., New York, N. Y. This invention provides an apparatus adapted to operate in dual capacity, as a buffer and a fender; provides means for causing the apparatus to automatically assume a position to operate in the latter capacity; and provides means manually operative for disposing the mechanism in position to operate in either of the capacities mentioned, and if desired without necessitating the chauffeur or driver leaving the vehicle.

**SHOCK ABSORBER.**—J. M. JACKSON, Parkersburg, W. Va. The invention refers to shock absorbers for vehicles, and the primary object is to provide an arrangement in which, under normal road conditions, there is no engagement of any parts and therefore no noise and no necessity for lubrication.

**SPRING WHEEL.**—D. A. GRAY, Chattanooga, Tenn. An object of this inventor is to provide a device which will have the advantages of a pneumatic tire, but which will not subject the owner of the vehicle to the delays incident to punctures and blow-outs such as occur with pneumatic tires.

#### Designs.

**DESIGN FOR A CRACKER OR LIKE ARTICLE.**—H. HANDY, 240 W. 104th St., New York, N. Y. In this ornamental design for a cracker or like article, the design shows a figure of a man of the old peasant type in a characteristic and picturesque posture.

**CARPET OR RUG.**—J. F. DU BOIS, Springfield, Mass., care of G. S. Squire, 25 Madison Ave., New York, N. Y. In this design for carpet or rug the fine effect is produced by an ornamental border inclosing a field of closely clustered figures without a centerpiece.

**DESIGN FOR RUBBER MAT BINDING.**—F. H. TIMKE, care of John Kroder and Henry Reubel Co., 107 E. 17th St., New York, N. Y. This design for rubber mat binding shows a binding of very simple, but attractive features of ornamentation.

**DESIGN FOR A BATHING CAP.**—R. PARKER, care of Parker, Stearns & Co., 300 Sheffield Ave., Brooklyn, N. Y. The first figure in this ornamental design shows a perspective view of a bathing cap, the adjusting ribbon being shown in an untied fashion, while the second is similar to the first, but showing the ribbon drawn and tied.

**DESIGN FOR A WINDOW DISPLAY.**—C. E. ISACKE, 96 Fifth Ave., Manhattan, N. Y., N. Y. In this ornamental design for a window display the figure shows a front perspective view of an attractive structure.

**NOTE.**—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

We wish to call attention to the fact that we are in a position to render competent services in every branch of patent or trade-mark work. Our staff is composed of mechanical, electrical and chemical experts, thoroughly trained to prepare and prosecute all patent applications, irrespective of the complex nature of the subject matter involved, or of the specialized, technical, or scientific knowledge required therefor.

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## Notes and Queries

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12935) E. R. R. asks: If a passenger train of all-steel cars and running in the electric zone should be derailed and make contact with the third rail, or the overhead wire should be torn down and come in contact with the cars, what effect would it have on the passengers? Is there a chance that in such an accident, the loss of life would be greater than any we have had with wooden cars or when heated by stoves? A. We do not think that the injury to passengers in a steel car would be any greater upon derailment, or other contact between the car and the third rail or trolley wire, than with a wooden car, if as great. The current would find an easy path over the exterior of the car to earth, and unless in some unusual circumstances should not enter the interior of the car at all. The bodies of the passengers would present so high a resistance that no injury should ordinarily result. Doubtless many nervous people would suffer from shock in such a case, but the shock would not be electric. However, no one can prophesy with any positiveness about this matter. Each case would have its own peculiar conditions and results.

(12936) H. C. K. asks: 1. Is there any truth in the disputed arguments among mechanics and engineers that a long screw driver will drive a screw easier than a short one if the handles are exactly the same? A. All mechanics find it easier to drive a screw with a long screw driver, or think they do. It is quite possible that the long handle is more easily kept in a right line with the screw, and thus aids in the work. We do not think the discussion a very important one. 2. Does it change the location of the poles on the surface of the earth if you change the inclination of the axis of the earth? A. The axis of the earth is all the time moving in the earth, and the latitude of places is changing a very little. This you will find in Todd's "New Astronomy," which we send for \$1.45 postpaid.

(12937) Mr. N. R. Crawford sends us the following formula for sugar-curing of meat, and we take pleasure in giving our readers the benefit of this advice: For 1,000 pounds of pork, take 30 pounds of pulverized salt, 5 pounds sugar, 1 pound black pepper, pulverized, and 1 ounce of saltpeter. Mix the above together. While the pork is hot, cut it up and rub the mixture thoroughly over the meat, rubbing it in all crevices. Lay it on a table or shelf and leave three days, after which go over and resalt again as the first time. In three days more go over it the third time. Allow it to stay spread about one week or ten days, and hang it up and smoke it. The above amount of salt, sugar and pepper will be sufficient to salt the 1,000 pounds the three times. The quality of the meat will be much improved over the old method. The first application must be applied while the animal heat is in the meat.

(12938) G. A. C. writes, referring to Query 12879, that we may possibly see a distant star by the light which is reflected from the surface of the earth to our eyes and thus increased much above what the star can send in a direct line to the eye; also that we see an object when we look at it by some power of the eye by which we do not have to wait for the light to come to us, but see instantly by the act of turning our eyes in the direction of the object; that thus a "telemicroscope" might be invented which would not simply penetrate space instantly, but disclose minute structures instantly in the most remote regions of space. We are not able to agree with this explanation of the mode in which we see a distant heavenly body, and may briefly point out the differences in our view of the matter. 1. It does not seem possible that we see a heavenly body by light which has been reflected from the earth, since we should then see the light coming up to us from the earth, and not down from the sky. We see an object in the last direction followed by the light from that body as it enters the eye. 2. Nor do we see an event in our field of vision at the instant it occurs, but only after the light which communicates the knowledge of the event to us has traversed the space between our eye and the place where the event occurred. Prof. Simon Newcomb set a mirror at Fort Meyer and sent light from the foot of the Washington Monument to Fort Meyer on the other side of the Potomac, and measured the time which the light required to go over that space and return. This is described fully in our Supplement No. 557, price ten cents. This being the case, Prof. Newcomb could not have seen the light till it had traveled over that space twice. It would have been the same if he had sent his light to the moon and back, or to a remote star. 3. There is an error in most people's minds as to what is meant by looking at anything. Some people seem to think that we do something with the eyes in looking. Nothing of the sort. To look at a thing simply means that we turn the eye so that light from that thing can enter it and thus enable us to see what that light can convey to the mind. We see what was happening there when the light left its source. 4. The idea of a "tele-microscope" is very old. In the early days of the New York Herald it published the famous "Lunar Hoax," which was that a combination of a microscope and tele-

scope had been made in England so that the image of the moon could be studied and the minutest details of its surface and inhabitants could be seen. It is not necessary to say that the hoax was short lived. The arrival of the first vessel from England exploded the story and revealed the hoax. No telescope can reveal minute details or annihilate space and time. In darting glances at some near object there is nothing sent from the eyes of the darter to the near object, unless it be an electric shock, or magnetic impulse, and these require time to travel.

(12939) D. L. M. asks: From the time of my childhood up to the present time I have heard the statement made and reiterated many times, that the earth is constantly cooling, and that the time will come when the earth will be a frozen body. Last Summer I heard a minister make the statement in a sermon. At once my mind nailed the absurdity (if it be such), for thermal or heat rays will not pass through a vacuum, but, on the other hand, we know that light rays readily do. Now from this you can readily see that the heat coming to us from the sun in the form of light rays is at once absorbed and converted into thermal rays, and these latter cannot pass beyond the air. Certainly there remains to be proven that there is a vacuum beyond the air. But from the fact that meteors are not heated until striking the air, we are of the opinion that beyond the air there is an absolute vacuum. This theory leads us to the contrary of the old theory. The earth is getting warmer and warmer. I am unable to see the flaw in this reasoning; if there is, I should be glad to know it. A. We regret that we do not find ourselves able to agree with your argument regarding the heating of the earth. The statement that heat rays will not pass through a vacuum contradicts common experience. The bulb of an incandescent lamp contains a high vacuum. It cools off after the current ceases to flow, and in a very short time is at the temperature of the surrounding air. The heat of the sun comes through space. It is a vacuum. Again, heat and light are the same energy, and not as you seem to think, totally different things. The rays which enter the eye become light. If they struck the hand they would be heat. Light and heat are both electromagnetic effects. The earth is continually radiating heat into external space. This is also a matter of common experience. The earth cools every night, and every winter still more so that ice forms over the water and in the ground. This could not be unless the earth loses the heat which it did in the daytime and the Summer has been given to it by the sun. Finally, the facts are against the hypothesis that the earth is growing warmer year by year. Vegetation has not changed in historical times. Italy has the same grape and olive harvests as in the days of Horace. For over two thousand years the climate of Europe has not altered sensibly. If the earth were growing warmer, this period is surely long enough to show a change of the line of growth of delicate crops, which would now grow farther north than they did in the classical period. Scientists hold that the earth radiates into external space all the heat which it receives from the sun, so that the average temperature remains the same year by year, or at least that the change is not perceptible in a relatively short time. It is also believed that the sun itself must ultimately reach a condition in which it will be unable to furnish its present supply of energy to the earth, and that then the loss of heat from the earth will exceed the supply received from the sun. Then will come the end of life on the earth unless the order of things changes.

(12940) L. G. B. asks: 1. It appears that the capacity for heat of the metals is low, that of water is high, that of hydrogen is still higher. What is the capacity for heat of a vacuum? A. The capacity of a vacuum for heat is infinite, which means that heat cannot be communicated to a space which is absolutely empty of ordinary matter. The radiation from the sun passes through space to the earth and the other planets without warming the space through which it passes. It will warm any matter which it may strike. 2. When gas is permitted to expand into a vacuum, there is an evolution of heat from the vessel, is there not? Doesn't that show that the vacuum contained heat which the gas drove out? A. So long as gas is expanding there cannot be any heating action from the gas. When a gas is driving other gas before it and compressing that gas, it is doing work upon something, and heat will be produced in the doing of that work. There would be no evolution of heat from the containing vessel at any time. If we correctly understand the use of that word in your inquiry. We mean that there would be no heat given off from the vessel itself which had not been communicated to it from some other source. If any heat was given off by the vessel which did not come from the compressing of the gas, that heat would leave the vessel colder, and must be accounted for in some other way; as, for instance, coming from the vessel because it was hotter than its surroundings, since heat cannot pass of itself from a colder to a hotter place.

### NEW BOOKS, ETC.

**STANDARD ORGAN BUILDING.** By William Horatio Clarke. Boston: Richard G. Badger, 1913. 8vo.; 219 pp. Price, \$2 net.

"Standard Organ Building" is presented as a text-book to guide church officers and organists in selecting an organ. The average organist may also use it as a reference book to familiarize himself with the mechanical side of his instrument. The mechanical and musical features embodied in good organ building practice are plainly indicated; and the point of view is always distinctly and exclusively practical and modern—only the present development of the organ is dealt with. The author is a well-known organist and a writer of music and musical literature. It is not so generally known that he was for some time proprietor of a large pipe organ factory. Here he determined the complex essentials of the best modern organs, and it is this knowledge—or such part of it as church authorities may find useful—that he imparts through this well-printed and well-arranged volume.

**FOOD AND FLAVOR. A Gastronomic Guide to Health and Good Living.** By Henry T. Finck. New York: The Century Company, 1913. 8vo.; 594 pp.; illustrated. Price, \$2 net.

Mr. Finck is an epicure. He would have his cook put through years of apprenticeship, as the French do. His gastronomic guide must be judged from the epicurean point of view. To the low-diet enthusiast it is anathema. Its descriptions of native and foreign dishes would ruin the resolves of a St. Anthony. But the work has an aim more worthy than that of making the mouth water. It preaches the gospel that flavor is the soul of food, a fact shamefully ignored. The psychic factor of desire must precede ingestion, or results will be unpropitious. To each cent spent for nutriment we add five more for flavor. Flavor, in short, has an appetizing value, a health value, a commercial value. The evolution of a discriminating appetite and the education of the cook must go hand in hand. But your glutton is never an epicure. Rational mastication must accompany the highest enjoyment of food, and in this enjoyment lies perfect assimilation and health. It is flavor that stimulates the flow of the digestive juices; it is the digestive juices that prepare the food for the extraction of nutriment. America's hit-or-miss methods of selection and preparation are sharply arraigned, and the blame is to some degree apportioned. Sensual indulgence is held to be a duty. But the mouth must do its share, or the digestive tract has to do it at ten times the expenditure of vital force, and dyspepsia results. Taste is limited to the qualities of sweet, sour, salt and bitter. The infinite variations of palatable sensation are to be credited to the sense of smell in combination with these elementary flavors. "Our Denatured Foods" are catalogued and scored in no uncertain language. In "The Science of Savory Cooking," right and wrong ways of preparing food for the table are distinctly set forth. Cooking is a science that electricity is soon to make exact. The specialties of France, of England, of Italy, and of Germany are given separate chapters that make us hunger as we read. In "Gastronomic America" we retrace the good old, well-ligh abandoned ways that made our tables tempting in the extreme. The masterly monograph concludes with reflections on the commercial value of flavor and the gastronomic value of odors. In many instances, our purveyors are overreaching themselves and are actually inviting loss instead of profit. In butter-making, for example, the greedy manufacturer adds excessive salt because it is cheaper than butter. Yet the more highly salted the butter, the less its market value; in this case dishonest ends defeat themselves! Mr. Finck has years of food-research behind him, and a thorough knowledge of his subject. Hence his book is not only delightful reading, but is helpful and instructive to the last degree.

**CALCUL DU BETON ARME. Formules, Tableaux et Abaques. Établis en application des formules de la Circulaire du Ministre des Travaux publics du 20 octobre 1906.** Par Ch. Aubry, ingénieur des Ponts et Chaussées. Paris: H. Dunod et E. Pinat, 1913. 20 francs.

Arduous and thorough labor has gone to the compilation of these formulas, tables, and diagrams, and this labor will save the time and money of the estimator in no small degree. By reference to this work, the worker in reinforced concrete is enabled to arrive at speedy results which would otherwise mean hours of laborious study and calculation. The author admits that into so large a mass of figures some errors may have crept. He will appreciate the report of any such that are discovered. The abaque are supplied upon loose leaves in a separate folio. Their convenient form and the clearness lent by their magnitude will not fail to appeal to the reader.

**A HISTORY OF LAND MAMMALS IN THE WESTERN HEMISPHERE.** By William B. Scott, Ph.D., LL.D., Blair Professor of Geology and Paleontology in Princeton University. New York: The Macmillan Company, 1913. 8vo.; 693 pp.; illustrated with 32 plates and more than 100 drawings by Bruce Horsfall. Price, \$5 net.

The author's university colleagues have given him the benefit of their advice and assistance in

the preparation of his work, which aims at making a somewhat difficult subject intelligible to the layman. Prof. Scott's own career was determined by a student's fossil-hunting expedition undertaken in the picnic spirit, as it were. The enthusiasm then generated breathes in every line of his work. He has taken great pains to make plain to the reader the methods of investigation, and the part which the successive modifications of bone and teeth play in the reading of these relics dug from the maw of the earth. The introductory chapters are followed by classification and geographical distribution of mammals and the successive faunas of North and South America; and the body of the history is followed by a discussion of the modes of mammalian evolution. A glossary and index are included, and the illustrations, showing restorations of prehistoric animals and scenes, deserve a word of praise for their care in preparation and for their convincing quality. In type, paper, and cover design the volume is a most attractive example of the publishers' art.

**A CORNISH GIANT.** By Edith K. Harper. New York: Spon & Chamberlain, 1913. 61 pp.; 12 illustrations. Price, 40 cents.

"A Cornish Giant" is a biography in pamphlet form of Richard Trevithick, the father of the locomotive. The brief biography is particularly addressed to the people of his own county, but this will not spoil it for those who delight in reading of pioneer inventors and their inventions. The relations between Trevithick and James Watt are amusingly sketched, and as we read we warm toward the solid personality of the six-foot-two blue-eyed Trevithick, misunderstood, jeered, ill-treated, yet always unconquerable—"the greatest and worst-used man in the county."

**SHIPS AND WAYS OF OTHER DAYS.** By E. Keble Chatterton. Philadelphia: J. B. Lippincott Company, 1913. 8vo.; 308 pp.; 130 illustrations. Price, \$4 net.

Uniform with the author's "Sailing Ships and Their Story," this beautiful volume chronologically considers the ways and means by which men built, launched, equipped, and set out with the craft of their various centuries. We learn how men handled these craft, both in peaceful navigation and in war. Still further is attempted; for we are introduced to so intimate a knowledge of the life afloat that we become one with it. None who delight in the landless ocean, and the tumbling and tossing upon it, can fail to have, in reading this story, a sense of dreams come true. He may work the tides with Caesar and William the Conqueror in their invasions. He may thrust Time back yet farther. For, thanks to old MSS. and curious drawings, we may enter largely into the hulls of the second century, and listen to the exclamations of those who marvel at the dimensions of some newly-completed monster of that day, just as we talk to-day about an "Imperator." Magdalene College, Cambridge, has permitted the reproduction in this work of illustrations from MSS. in the Pepysian Library. One shows a sixteenth century ship designer at work; another, the interior of a seventeenth century ship; still another, the "orthographic symmetry" of the same. These are but a few of the valuable illustrations to be found in the work.

**THE ROMANCE OF SUBMARINE ENGINEERING.** By T. W. Corbin. Philadelphia: J. B. Lippincott Company, 1913. 8vo.; 316 pp.; illustrated. Price, \$1.50 net.

Although the submarine boat has been employed as an engine of war since 1776, it is a curious reflection that as yet not one enemy has fallen before it. The only victims have been the crews. Mr. Corbin's book is a popular account and description, not only of submarines, but ship-salvaging, recovering sunken treasure, the building of breakwaters, and in fact all human accomplishments where it is necessary to work beneath the water. These are themes that invite adventurous handling, and the author has taken full advantage of his opportunity. We read of the feats of the divers, of the breakwaters built with "fifty-ton bricks," and of the secret air-purifying compositions used in connection with diving apparatus. Thus, with thumb-nail sketches of the heroic men and illustrated details of their tools and their work, the author constructs for general reading a very pleasing volume.

**HANDBUCH FÜR HEER UND FLOTTE.** Enzyklopädie der Kriegswissenschaften und verwandter Gebiete herausgegeben von Georg von Alten, Generalleutnant z. D., fortgeführt von Hans von Albert, Hauptmann a. D., unter Mitwirkung von mehr als 300 der bedeutendsten Fachautoritäten. Berlin: Deutsches Verlagshaus Bong & Co., 1913.

One of the most important articles which has thus far appeared in the "Handbuch fuer Heer und Flotte," of which installments 61 to 64 lie before us, is that of General Count von Schlieffen on the Battle of Jena, and the reason why the Prussians suffered defeat in that memorable engagement. The present installments of the Handbuch take the student from "Istoria" to "Kaiser-Friedrich-Klasse." The more important articles of a military character are those on the military powers "Italy" and "Japan." No less than eight authorities collaborated in producing the article on "Italy." The article on "India," too, deserves comment. It was prepared by the well-known authority Lieutenant Colonel le Juge. Lieutenant General von Zwehl writes an illuminating essay on Infantry and juvenile military education. Tables, charts, illustrations and diagrams have been freely used throughout these installments.



# The Cadillac Company has no intention of marketing a six cylinder car

**T**HE Cadillac Motor Car Company has always believed that there are so many good features in the Cadillac Car, that its advertising space could be best utilized exclusively in acquainting the public with those advantages.

We regret, however, that the occasion arises which makes it appear desirable for us to depart, temporarily, from that policy.

Inasmuch as it is not possible for us to control the "mouth to mouth" advertising with which we are favored, and inasmuch as that gratuitous publicity may sometimes contain elements of inaccuracy, unintentionally perhaps, on the part of the authors, we feel that we would not perform the duty which we owe to the public and the duty which we owe to ourselves, if we did not correct any misunderstandings or misconceptions which may exist concerning the methods, policies and plans of this company.

The pre-eminent position of the Cadillac Car as the "Standard of the World," its recognition as the criterion of excellence in practical construction, are not matters of mere chance.

For eleven years the Cadillac has been manufactured and marketed upon well defined principles. Adherence to those principles has been the dominant factor in Cadillac success.

The Cadillac has never aspired to ideals set by others; it makes its own ideals and raises them higher and higher.

The Cadillac has never striven after the achievements of other plants; it is a school and a model unto itself.

The Cadillac has never been obliged to make apologies for its product. It has never been obliged to smother its past, nor to discredit it by wiping the slate clean and beginning all over again.

The immaterial and the impractical, the fad and the fallacy, the delusion and the shallow "talking point" have no chapter in the "Story of the Cadillac."

The "Story of the Cadillac" is the story of that mechanical and commercial advancement which makes for permanency. The Cadillac product has been only that which its makers knew to be right; that which its makers knew would satisfy and give to the purchaser "value received" in abundant measure.

The policy of the Cadillac Company has ever been to avoid exaggeration and overdrawn statements. Its policy has ever been to under-claim rather than to over-claim.

The Cadillac Company is gratified that the public feels secure in accepting Cadillac representations at their full worth. These representations are so accepted because the Cadillac Company has never misled and because the public could always expect and has always received more than was offered.

The Cadillac Car of today has behind it the experience gleaned in the successful production of the seventy-five thousand Cadillacs which have preceded it—by far the greatest number of high grade motor cars produced by any one manufacturer in the world.

The Cadillac Company is ever alert—its ear is ever to the ground; it feels the throb of the public pulse. Yet never has it yielded to clamor by giving endorsement to principles which would take advantage of the uninitiated or the uninformed, even though temporary benefits might accrue.

The experimental division of the Cadillac Company is not excelled in the motor car industry. We do not believe it is even equaled.

Every design, every appliance, every idea, every principle offered which has a semblance of merit, is subjected to the most gruelling tests.

For every idea or feature adopted or considered worthy of the Cadillac seal of approval, scores are discarded.

One reason why most of the new ideas of inventors and manufacturers are first offered to the Cadillac Company is because these inventors and manufacturers realize that with the Cadillac seal of approval, their future is practically certain.

As an example, take the electrical system of automatic cranking, lighting and ignition, first introduced by the Cadillac Company and now used almost universally.

Take also the two-speed axle introduced into the present Cadillac, and which engineering authorities on both sides of the Atlantic are predicting will soon come into general use.

Witness this from "The Automobile Engineer" published in London, England. In commenting upon Cadillac engineering progress and Cadillac initiative, it says:—

"Already there is a very decided movement among other makers to try and provide some type of two-speed rear axle similar to the Cadillac, for 1914 or 1915."

In our experimental division we have built automobile engines of almost every conceivable type and size and have tested scores which we did not make ourselves.

We have built them with one, with two, with three, with four and with six cylinders. We have never tried five.

We have cast them en bloc, we have cast them in pairs and we have cast them singly. We have made them with water jackets cast integral and with copper water jackets. We found the latter method most expensive, but the most efficient—hence we use it.

We built cars with one cylinder engines, more than 15,000 of them, and they were good ones. "One-lungers" they were called, and they are practically all going yet, after eight to eleven years of service, hundreds of them having passed the 100,000 mile mark.

We built a few cars with two cylinder engines and they were as good as that type could possibly be made. But we never marketed any of them although the rumor was current that we intended doing so.

Yes, and we built cars with three cylinder engines, as good of that type as could be made. Probably few readers ever heard of such a car.

Some people thought they wanted that kind and they bought them. But not from us. Rumor had it, however, that we intended to market them.

Cars with four cylinder engines! We have built and distributed more than sixty thousand (60,000) of them. That was something more substantial than a rumor.

Cars with six cylinder engines! We have built a number of them in the last four years. We have tested them to the utmost, and they proved to be good ones—by comparison. In fact, by comparing them point for point with a number of the most highly regarded "sixes," which we bought for the purpose of making comparisons for our own enlightenment, we failed to find a single car which, in our opinion, outpointed our own, and our own outpointed most of them.

These experiments may have given rise to the rumor that the Cadillac Company contemplates marketing a six cylinder car. But,—as in the cases of the two and three cylinder cars—such rumor is entirely without foundation. This Company has no such intention.

And we made other comparisons as well; in fact nothing worth while was overlooked or omitted.

Our tests, investigations, experiments and comparisons demonstrated conclusively to us, that a four cylinder engine, designed with the skill and executed with the precision which characterizes the Cadillac engine—and scientifically balanced, affords the highest degree of all 'round efficiency possible to obtain.

These tests further demonstrated that with such an engine, in conjunction with a properly designed two-speed axle, there is obtained an extraordinary range of operating flexibility, an extraordinary reduction of friction, an extraordinary degree of operation and maintenance economy, an extraordinary degree of luxurious riding qualities, and a reduction of vibration, particularly at high speeds, almost to the vanishing point.

We have cited the foregoing facts because we believe that the public is entitled to know them, because we believe that we owe it to the public to make the facts known and because we want the public to know that the Cadillac Company leaves no stone unturned, that it spares no expense in its efforts to discover and to provide that which it knows to be right, that which it knows will satisfy and that which will give to the buyer "value received" in abundant measure.

**And above all, the Cadillac Company has no intention of departing from that policy.**

There can be no better evidence of the appreciation of the Cadillac policy than the fact that there have already been manufactured and distributed, more than 9000 of the 1914 Model Cadillacs, amounting in selling value to more than eighteen millions (\$18,000,000) of dollars—a volume of cars which nearly equals, if it does not exceed, that of all other 1914 high grade American cars combined, selling at or more than the Cadillac price, regardless of their numbers of cylinders.

CADILLAC MOTOR CAR CO.  
DETROIT, MICHIGAN



## The Magic Flight of Thought

AGES ago, Thor, the champion of the Scandinavian gods, invaded Jotunheim, the land of the giants, and was challenged to feats of skill by Loki, the king.

Thor matched Thialfi, the swiftest of mortals, against Hugi in a footrace. Thrice they swept over the course, but each time Thialfi was hopelessly defeated by Loki's runner.

Loki confessed to Thor afterwards that he had deceived the god by enchantments, saying, "Hugi was my thought, and what speed can ever equal his?"

But the flight of thought is no longer a magic power of mythical beings, for the Bell

Telephone has made it a common daily experience.

Over the telephone, the spoken thought is transmitted instantly, directly where we send it, outdistancing every other means for the carrying of messages.

In the Bell System, the telephone lines reach throughout the country, and the thoughts of the people are carried with lightning speed in all directions, one mile, a hundred, or two thousand miles away.

And because the Bell System so adequately serves the practical needs of the people, the magic of thought's swift flight occurs 25,000,000 times every twenty-four hours.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY  
AND ASSOCIATED COMPANIES  
**One Policy      One System      Universal Service**

### JUST PUBLISHED Wireless Telegraphy and Telephony

Simply Explained  
By ALFRED P. MORGAN

170 Pages, 156 Illustrations

Price \$1.00 Postpaid

The simplest, latest and most comprehensive popular work published on wireless, for the wireless operator, amateur or professional

THIS is undoubtedly one of the most comprehensive treatises on the subject, and a close study of its pages will enable one to master all the details of the wireless transmission of messages. The author has filled a long-felt want and has succeeded in furnishing a lucid, comprehensible explanation in simple language of the theory and practice of wireless telegraphy and telephony.

The book treats the subject from an entirely new standpoint. It is well illustrated by over one hundred and fifty interesting photographs and drawings. All diagrams have been made in perspective, showing the instruments as they actually appear in practice. The drawings are carefully keyed and labeled. Many of the photographs are accompanied by phantom drawings which reveal the name and purpose of each part.

A book the wireless experimenter cannot afford to be without. It enables one to design and construct apparatus. Also valuable to the layman

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### An Organ on Which Color Compositions are Played

(Concluded from page 163.)

high degree of pleasure to the sensitive observer. Scriabine, the Russian musician, in a recent orchestral composition, has attacked the corresponding color score, although the work in its twofold aspect has not yet been performed.

For years the term "tone-pictures" has been applied to musical compositions, and the art of orchestral coloring has been made the subject of many treatises. But the new art is not limited by the correspondence of shades of color to musical tones. Immensely more delicate gradations may be obtained in color than are possible in musical sounds. We know, for instance, that in music a dominant note, its major third and perfect fifth together, make up the major chord of that key. Lower the middle note of the chord by a semitone, making it a minor third, and we have the minor chord of that key—a very different thing indeed. Much more delicate gradations would be obtained on the color organ.

The craving of the mind for a definite key seems to hold good of a color composition and, as before remarked, the influence of rhythm is very perceptible. A color composition having a strong march rhythm is as effective as a musical composition in the same style, and Prof. Rimington tells me that he has actually waltzed to a color composition composed in waltz time.

Apart from their purely artistic value, many of these experiments are extremely interesting from the psychological point of view.

Prof. Exner, of Germany, has made investigations to determine how far similar colors affect the majority of people in the same way, but only with regard to single colors, and upon some points he obtained great unanimity of opinion. But the importation of rhythm into color widens the field of such investigations enormously, and numerous possible experiments will at once occur to the reader. Such experiments will doubtless help us in framing an answer to the extremely difficult question: Why are certain color compositions, and not others, considered beautiful? The whole question of the origin of the feeling for beauty is very complex and any aid to the solution of the problem must be heartily welcomed. Prof. Rimington, in his work on the subject, advances several arguments to show the great importance of a developed color sense to a community from the point of view of its commercial prosperity as well as its aesthetic development. It is to be hoped that many other workers will enter this richly fruitful field of investigation, and to America, with its keen interest in new developments, its strong artistic and psychological schools, and its readiness to endow research, we may confidently look for further elaboration of the new and fascinating art of Color Music.

### The Coolidge Roentgen Ray Tube

(Concluded from page 157.)

the most important contribution to Roentgenology since the birth of that science, and it has found an important place in various fields.

Through the courtesy of Dr. Lewis Gregory Cole, Professor of Roentgenology at Cornell University Medical College, we were able to examine one of the new tubes which has been used with notable success. Not only is the operator able to adjust it with greater accuracy, but he is assured of stability and exact duplication of results, greater flexibility, a greater output of rays, a longer life of the tube, and the absence of indirect rays developed at various parts of the glass bulb which, of course, affect the sharpness of the impression. The new tubes have a vacuum about 1,000 times as great as the vacuum of the ordinary Roentgen ray tube and make use of a tungsten filament as a cathode, the material out of which, as every one knows, the filament in the ordinary tungsten incandescent lamp is made. This cathode, unlike that in the older type of tube, must be heated in order to render the tube active and capable of being ex-

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A Free Opinion as to the probable patentability of an invention will be readily given to any inventor furnishing us with a model or sketch and a brief description of the device in question. All communications are strictly confidential. Our Hand-Book on Patents will be sent free on request.

Ours is the Oldest agency for securing patents; it was established over sixty-five years ago.

All patents secured through us are described without cost to patentee in the Scientific American.

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cited. When a current from a storage battery raises the tungsten filament to the required temperature the electrons are liberated from the cathode by the high potential current ordinarily employed and furnished from an induction coil or transformer.

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The controlling apparatus is such that an exact duplication can be obtained and, at the same time, the tube is so flexible that it can be operated at a penetration so slight as to show the fine blood vessels of the hand or foot at one instant, while at the next it can be increased so that a penetration far exceeding anything possible with the ordinary tube can be secured, thus making it available for all kinds of Roentgenographic and therapeutic work.

The life of the new tubes is placed by Dr. Coolidge at a minimum of a thousand hours of constant running, so that the tube is more likely to be impaired as the result of accident than from wearing out. The new tube avoids the detrimental effect of the indirect rays generated in the wall of the anterior hemisphere of the tube by secondary or deflected cathode streams which blur the image and give rise to secondary rays in the tissues of the body interposed. To one seeing the apparatus for the first time the utter absence of fluorescence in the glass is most marked.

With the new tube a scale of length of exposure and current required with different lengths of spark gap has been compiled which shows exactly what is needed in photographing the various parts of the body. In one instance ten exposures were made in 4/10 of a second of actual time. With the stomach, using a spark gap of five inches and a current of 110 milliamperes, the time of 0.06 second was required, while for the detail of the spine, using a current of 30 milliamperes, 15 seconds would be required.

The original tests made in the research laboratory with experimental apparatus on animal tissue and strips of metal were repeated in Dr. Cole's laboratory and a series of test plates were made which showed clearly the differences obtained by varying the conditions in a number of exposures on the same subject.

### A New Scheme for Selling Patents

In a neighboring city not far from New York, there is a patent bureau bearing a foreign name, which puts forward a claim of having special facilities for selling patents abroad. The carefully worded correspondence which this bureau carries on with the inventor is alluring in character and is designed to entice the unsuspecting client into its fold.

As soon as a patent is issued in the United States, an attractively worded letter is received by the inventor, informing him that the parties of the first part make frequent trips to Europe and are in direct contact with European manufacturers and act as their agents, and that such manufacturers are anxious and eager to undertake the manufacture of this particular patent on royalty basis, or buy the patent outright for a reasonable amount. They usually state that they consider the patent very valuable for the European market, and "we could contract the manufacturing right on a strictly commission basis

of ten per cent." They then state further:

"If you have no foreign patents, would you consider an offer for the manufacturing rights? Are you open for an offer? Kindly reply. We mean business."

All of the above suggestions are in the body of the letter and are typewritten. Then written in ink in a broad and scrawling hand, is the following: "We are able to close a contract with a German manufacturer."

We are constantly receiving letters from inventors who have received these circular letters from the parties above named, and who are considerably excited over the prospect of closing a contract for the sale of a foreign patent when perhaps no patent has yet been obtained there. It may or may not occur to the inventor that it is a singular thing that within a few days of the issuing of his United States patent a German manufacturer should be eager to step in and make a contract for the German rights. In his eagerness, however, to launch the new enterprise the inventor is usually taken unawares and does not reason out the inconsistency of the proposition.

One of our correspondents wrote to the "Patent Bureau" as follows:

"In your former letter of December 13th you say in a postscript, 'We are able to close a contract with a German manufacturer.' I suppose by this that you mean you have a definite manufacturer in view with whom you know that you can make a contract. I asked you specifically on this in my letter of December 23rd, but you disregarded my inquiry in your last letter.

"When you write please give me the fullest information on the matters I have requested, as a fair and clear understanding is very essential for doing business satisfactorily."

In reply to this letter, which the Editor has before him, this question in regard to who the manufacturer is who is ready to sign the contract, and whether there is such a definite manufacturer ready to sign the contract, remains unanswered. We suggest to the guileless inventor who may be enticed to open correspondence with these parties to assure himself in regard to these facts before entering into any contract with the parties in question. We are of the impression that the inventor will discover before any negotiations can be entered into that a considerable payment will be exacted in each country before any disclosure will be made.

They state in a letter which we have before us:

"Your article must be offered for sale in a businesslike manner to present literature in their languages, with cuts, photos, etc. Can you submit us such literature, cuts, samples, etc.? Without the same we cannot do anything. To undertake the sale, to have such literature made in each country, in their respective languages, we charge you \$... for each country, and we will send you proofs of the same."

If the reader has a patent which he wishes to sell in a foreign country we suggest before making any arrangements involving the payment of any retaining fee that he shall demand full information in regard to what success others have achieved, and who the parties are who are so anxious and eager to close a contract in some foreign country almost simultaneously with the issuance of the patent here.

### A Recent By-product Utilization in American Soap Manufacture

By L. Lodian

In all soap manufactories there accumulates in due course a soap-kettle refuse known in the trade terminology as the "nigre." What to do with this "nigre" has long been a problem to the student of the soap industry. True, he could work some of it up with low-grade colored soaps, make it into the so-called black tar soaps or use it for a brown-black dog soap as a flea killer. But tar soaps are of exceedingly limited use, while any soap white or colored is a good destroyer of fleas, as the alkali lather attacks them instantly.

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"nigre" has been used for the turning out of the coarse brown bar-soap known as carbolic soap (10 to 20 per cent of the acid being worked into the "crutch" or kettle-boil), and this is extensively used there as a disinfecting hospital-floor or prison-floor scrubbing soap; while it also makes a capital cleansing soap for carpets and garments. On the other hand, in America carbolic bar-soap is scarcely known, especially in the city retail stores, while its use as a fair-grade toilet soap is almost a negligible factor. The odor is disliked by the vast majority of people, so there has never been any chance for the "nigre" in that direction.

So what to do with the "nigre" remained a question. It was thought to be worth more than for fuel use, or for running away as waste, so one large company decided to experiment; and two years ago it put on the market a quantity of cases of the kettle-refuse soap, at a price lower than any other soap, i. e., two big laundry size cakes for five cents. Its salesmen said that it would never succeed, that its blackish-brown color would be against it.

To the surprise of the Jersey City nigre-soap outpitters calls came from retailers for more cases, and the manufacturers constantly replied that there was not enough "nigre" to supply the demand. This condition has continued up to the present time.

What is all the more remarkable is that the American firm has succeeded in marketing a far more difficult refuse-product than ever appeared in Europe. What is wasted there is here utilized. The veriest dregs of the soap-kettle, consisting of refuse membrane-tissue particles and even the tiny sand-like bony, gritty minute portions which settle to the bottom of every kettle, are all utilized now in this nigre-soap. An advantage too lies in the fact that in washing practice, these fragments cause a slight friction sufficient to form a foaming lather.

Nigre-soap must necessarily be a cheap compound, a resin-and-salt product; consequently it sweats in humid weather like the low-priced toilet-soaps to an almost unpleasant stickiness, and "blooms" or effloresces some of its elements in dry spells. In the wash though it acts and wears well and can be used on the most delicate bleached silks, which properly rinsed show a snow white appearance, as the foam from the soap has little color—a feeble dinginess only. The cake wears down without breakage to an almost paper-thin tablet.

Altogether, considered as a by-product, this nigre-soap is a creditable one, and it reveals what may be accomplished by trying; and what one firm has successfully marketed in the East, others in various sections of the country might duplicate.

The refuse membrane-tissue dregs or filaments, in an extremely comminuted form, naturally segregate in the molten grease; and after working into soap, they are often still found in the cake in an agglomerated condition—dissolving, however, in the wash uniformly with the rest of the soap. The congregated refuse tissue seen here and there in parts of the contrasting smooth-grain black-brown soap, often presents an almost picturesque appearance, especially when wet, as of rare-marked mahogany specimens, or beautiful dark-hued fossils.

According to Lamborn, the ensuing analysis of the average nigre soap-kettle refuse explains its make-up:

Water	64.32 per cent
Soap, anhydrous	29.04 per cent
Alkali, free, NaOH	0.52 per cent
Alkali, combined, Na <sub>2</sub> CO <sub>3</sub>	2.17 per cent
Non-determined	3.95 per cent

A soap works instances a fraudulent use of the by-product in low-grade or certain dark-colored toilet soaps; it also lists all of the dishonest "fillers"—talc, barytes, earths, mineral fillings, and the other tricks for weighting soaps; and these are mentioned so that the reader may be warned against their use.

The American Forestry Association has just elected Henry S. Drinker, president of Lehigh University, and P. S. Ridsdale, as its president and secretary, respectively.

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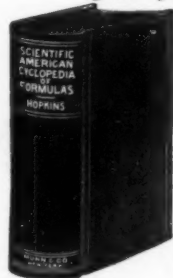
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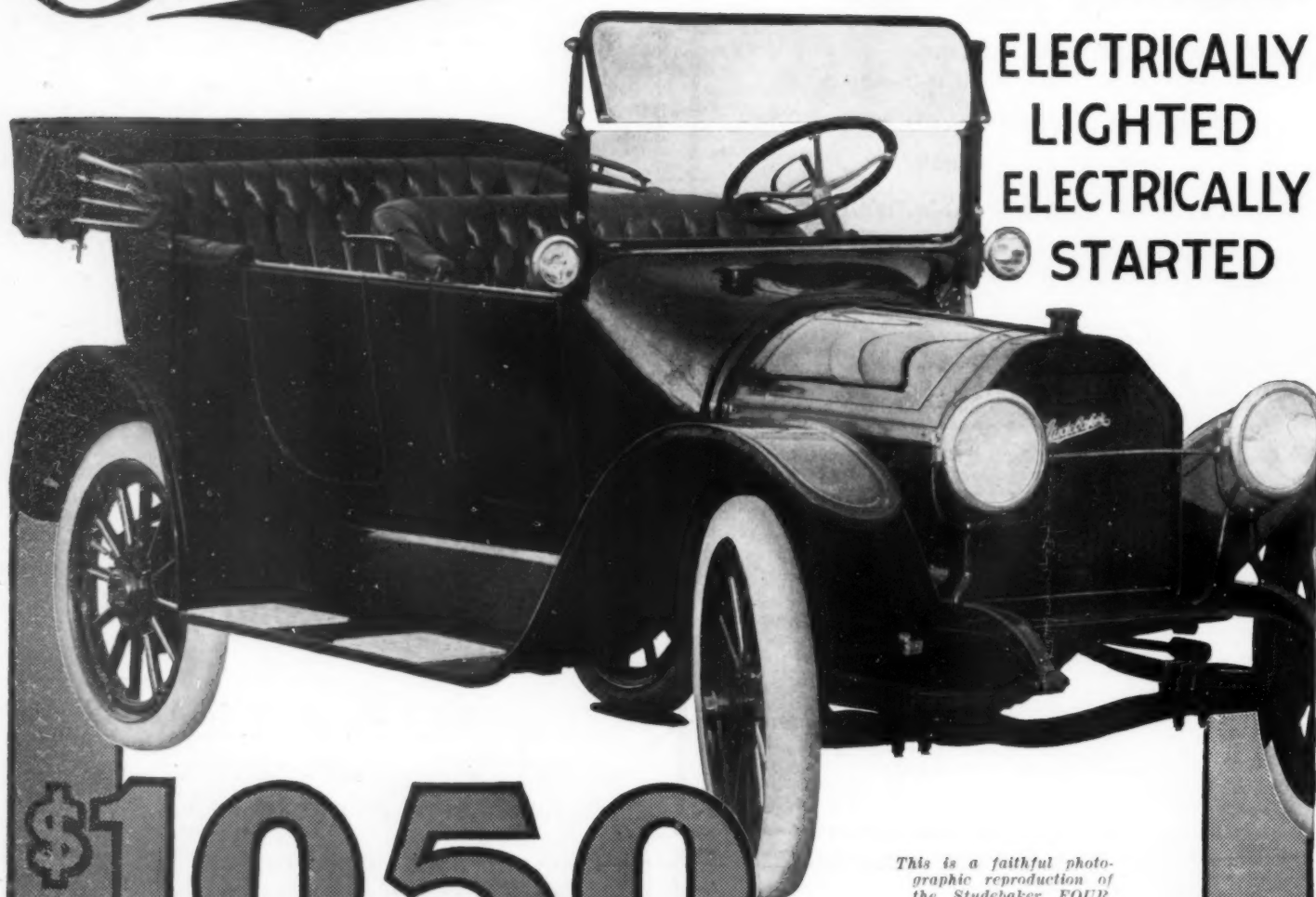
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